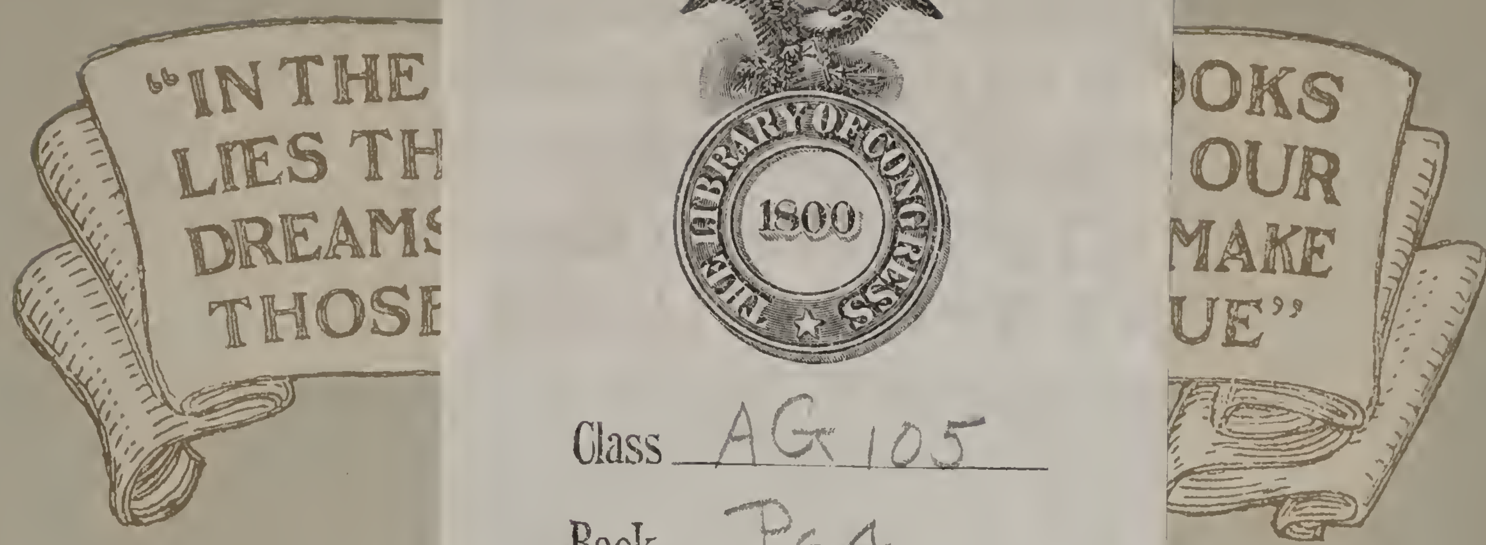
PICTURED KNOWLEDGE


"IN THE
LIES TH
DREAMS
THOSE
OOKS
OUR
MAKE
UE"

It used to be thought that volcanoes were simply mountains with holes in them, like big guns through which the internal fire spouted up. It is now known that volcanoes build their own mountains and that every volcanic mountain at some time rose out of a relatively level surface, much as ants build sand craters through cracks in a sidewalk. Fig. (1) shows lava deposited by a former eruption, (2) the original strata. Water sinking down to the fire reservoir (3) makes the steam of an eruption. (4) is rock which, although very hot, is not molten because of the pressure above it. At (5) the pressure has been released owing to the arching of the layer above, so the rock becomes molten and out it spouts!

PICTURED KNOWLEDGE

THE NEW METHOD OF
VISUAL INSTRUCTION APPLIED TO
ALL SCHOOL SUBJECTS

Dedicated to Our Boys and Girls

VOL. II

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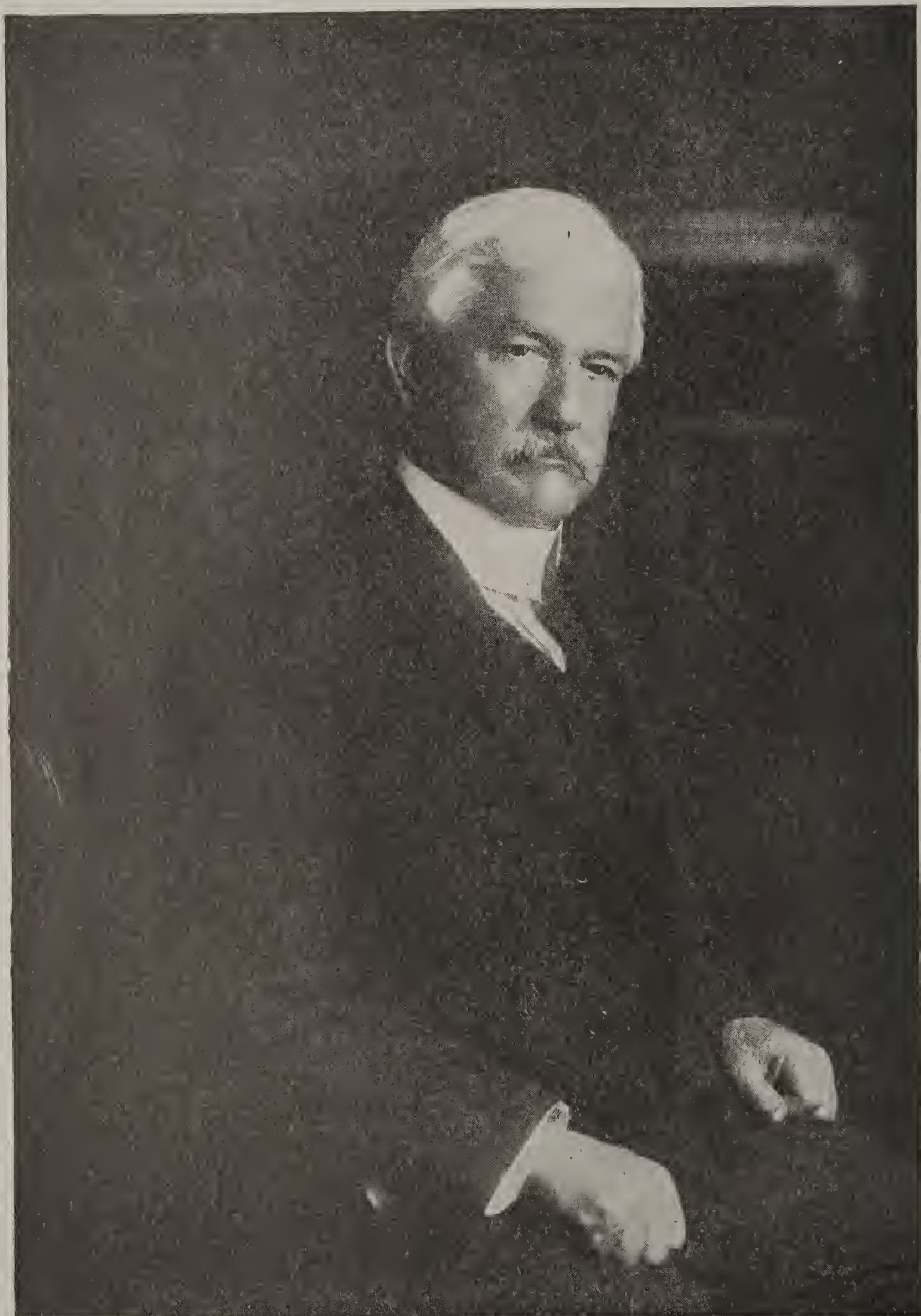
CHICAGO

PICTURED KNOWLEDGE

WE can now travel in any land, in any season, or among any tribe or race, snugly ensconced, with a few illustrated books, by our own fireplace. The limit and range of what pictures can do is steadily increasing. One can know many of the wonders of the vast new world of the microscope and telescope without ever looking through an eye glass. It would be a curious question for the imaginative mind to work out how far an education based upon a wise selection and proper gradation of pictures might today be carried without the ability to read. If all written or printed records of the present time should be lost it is surprising to reflect how much of what makes life interesting could be reproduced by pictures alone. Seeing is not only believing, but understanding, and a single judicious picture or blackboard drawing often tells in a moment what it would take paragraphs to describe, if indeed words could ever give it at all.

G. Stanley Hall

The Man Who Conquered the Mosquito



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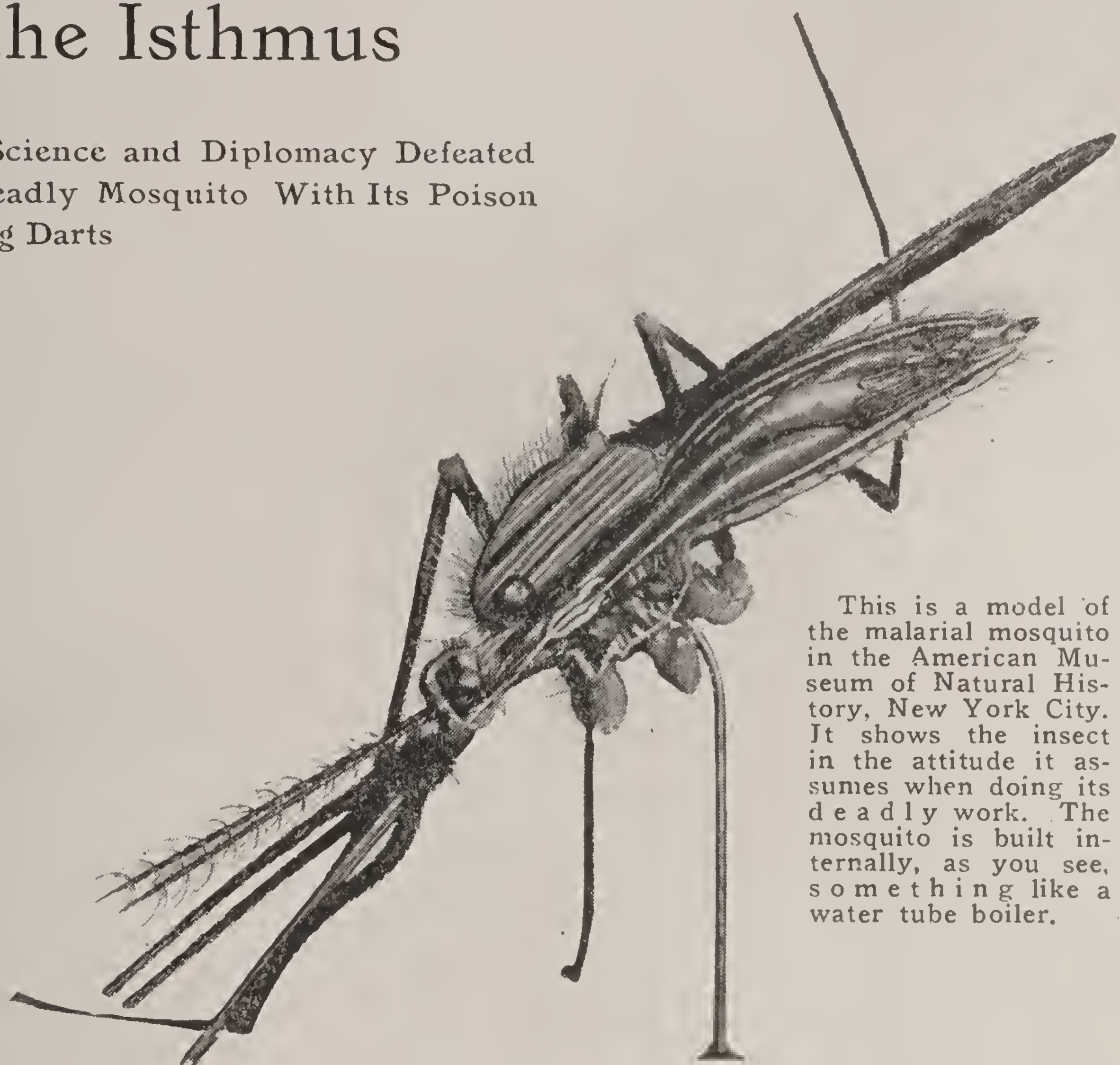
"He is a strongly built man, with a kindly smile and twinkling eyes. And how sweet and human he is."

Colonel Gorgas and the Little Terror of the Isthmus

How Science and Diplomacy Defeated the Deadly Mosquito With Its Poison Bearing Darts



This is a model of the malarial mosquito in the American Museum of Natural History, New York City. It shows the insect in the attitude it assumes when doing its deadly work. The mosquito is built internally, as you see, something like a water tube boiler.

"HELLO Central! Give me the Sanitary Commission. Hello! Is this the Health Office? There's a mean, bloodthirsty mosquito in my house. Send an officer, please."

Where Policemen Arrest Mosquitoes

Such nonsense! Is it meant for a joke? No. It is an everyday happening, along the Panama Canal, to call a health officer to arrest a mosquito burglar. There are terrible beasts and snakes in the hot, green jungle, but no wild animal in tropical America is as dangerous as the mosquito. It may give malarial or yellow fever to anyone it bites, and then, by biting the sick, spread these diseases to well people. After a full meal of blood the mosquito hides, high on the wall, in a dark corner or closet or hanging garment, and goes to sleep. If one is in a house health officers find it.

Mosquitoes Worse Than Jungle Beasts

In the Pest Hole of the Americas

In 1900 Panama was, as it had always been, the worst pest hole of the Americas. For nine

months in the year it rains there every day. Fifty varieties of mosquitoes breed by billions in the swamps and slow, broad streams. Doctors learned that certain diseases are given by these little nuisances. If white men were to live there and dig the canal, the mosquitoes had to go. So the government sent Colonel Gorgas, an army engineer and surgeon, and made him family doctor of the Canal Zone.

Fifty Styles of Mosquito Bites

How They Got Rid of Mrs. Y. F. Mosquito

There are many kinds of people in Panama—Americans, Spanish-Americans, Negroes, Chinese coolies. Natives never have these fevers, and are ignorant about health rules. They could not understand why the "wiggletails" in open rain-water barrels and out-of-door closets did any harm. They could see no use in cleaning and fumigating their houses. But Colonel Gorgas was so jolly and friendly, they did anything he asked, just to oblige him. They let him put in a water system and sewer and fill up the pools in the villages, although it no doubt seemed a queer thing to do.

Just to Oblige the Colonel

Then Came Mrs. Malaria Mosquito

That settled Mrs. Yellow Fever Mosquito, but Mrs. Malaria Mosquito laid her eggs everywhere. All along the Canal Zone, swamps had to be drained. Then, back in

In the Panama Jungle

"There are terrible beasts and snakes in the hot, green jungle, but no wild animal in tropical America is as dangerous as the mosquito." Here's a bit of the jungle with a malaria-breeding puddle. And the natives in the picture, Negroes, are of the kind that "never have these fevers and are ignorant about health rules." The big palm with the frayed leaves on the right is a banana tree. See how the girl is carrying one of the native "water buckets," an earthen bowl, of which there are several more on the ground at the left.

the hills, across every rivulet that flowed to the villages, iron ash cans were set on plank bridges. The cans were filled with crude carbolic acid, resin and caustic soda. This oily poison oozed, drop by drop, into all the streams and spread over the water. When the mosquito wiggletails came up to breathe they were killed. Negro porters, carrying tanks, sprayed the poison into every pool. Doors and windows were screened with copper wire. A person sick of fever was rushed to a hospital. Health officers vaccinated people. Others trapped, poisoned and shot wharf rats at the seaports, for rat fleas carry the black plague. It has cost millions of dollars to make this hot, damp country as healthy as a northern city. It will cost more millions, every year, to keep it so healthy that ships will not carry diseases elsewhere.

Million Dollar War on Wiggletails

The New "Bill of Health" for the Zone

What do you think the health officers call themselves? "Ditch diggers." Colonel Gorgas says that, by keeping the workman in good health, the Sanitary Commission took half the dirt out of the Culebra Cut. Through his good work he keeps families together, mothers and babies on the green, palm-shaded lawns, a swarm of rosy children tumbling boisterously in and out of white school houses. He says he intends to make the Canal Zone so healthy, that a man will have to break a leg to get into a hospital.

Result of the Doctor's Great Work

No other work done on the Canal has been more important or difficult; no other has affected so many far-away lands and peoples. In countless places Colonel Gorgas' methods of fighting germ diseases and insect carriers are being copied. And how sweet and human he is. Do you want a picture of him?

A Lesson for the People

A Pen Picture of the Soldier Doctor

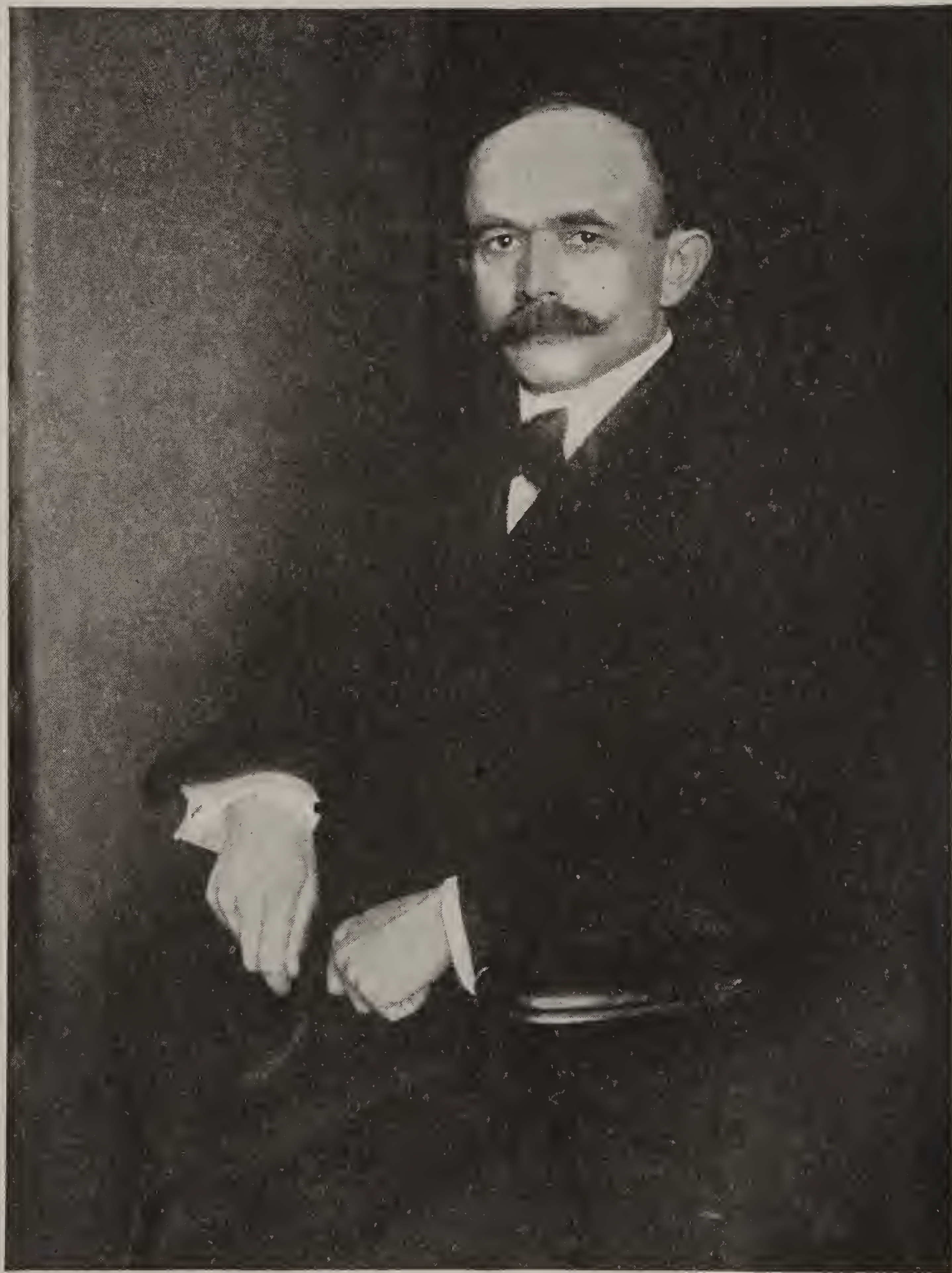
He is a strongly built man, with a kindly smile and twinkling eyes. He wears white duck, a soft shirt and Panama hat. In any native house he may be seen, with fat, brown children scrambling over him. He slaps the men and boys on the shoulder. To the lady he says: "Senora (Madam) you certainly do make the best lemonade on the Isthmus. I just turned your rainwater barrel upside down." Then to the husband:

But the Jolly Doctor Means It!

"Senor, if you don't fill up that puddle in your back yard, I shall have to put a fine fellow in jail. How many toes has baby Rosalie got? Five! That's just the right number to play a game I know:

"This little pig goes to market"

The Man Who Taught the World That "No Boy Can Be a Criminal"



"Today, hundreds of honest and useful men bless the 'kid' Judge for giving them a new start, and saving them from the disgrace of having been in a reformatory."

The "Kid" Judge

THAT doesn't mean a *child* judge, but a judge of children. It is the slang nickname that the boys of Denver gave to Judge Lindsey. It is an affectionate pet name, too, for they love him. He would not trade that name for the proudest title in the world. This is how he got it.

An Appeal to a Boy's Honor

In 1900, when he was thirty-one years old, he was elected judge of the Probate Court in Denver. There was no Juvenile Court then. When a boy was arrested his case was tried by any one of several judges. One morning a "gang" of boys were brought before Judge Lindsey, charged with robbing a pigeon roost. That was stealing. The law called it a crime, no matter whether the guilty person was six years old or sixty. The boys hadn't thought of it that way. In taking the pigeons they saw, they were just teasing an old man who was ill-tempered and mean to boys. Judge Lindsey explained the law. He must send them to the reformatory at Golden.

Robbery of the Pigeon Roost

Then he remembered something. With a crowd of boys he had once started to raid that same pigeon roost, to "get even" with the cross old farmer. The other boys did do it, but Benny Lindsey backed out because he was afraid. Those boys had all grown up into good and useful men who would not think of stealing. What if they had been caught and punished as criminals?

And then the Judge Remembered

"Would I be here now, to judge these boys? No. I would probably have been discouraged and turned bad."

Then He Said This to the Boys:

"Boys," he said, "do you know what a parole is? Prisoners of war in camp, where they cannot be locked up, give their word of honor not to escape. I will parole you. You must report to me once a week. If you break your word and get into trouble again, I shall have to send you to the reformatory. I will be criticized for giving you this chance to reform yourselves. If I trust you, and I believe in boys, why, you must stand by me."

He was a small, boyish-looking man, with a big head and frail body, and he talked to the boys as though he were one of them. So they called him the "kid" Judge, and stood by him, because he understood "kids." So successful was this new idea of getting boys to behave "on honor" that other judges sent all the children to Judge Lindsey.

How the Boys Stood By the Judge

A Live Boy vs. a Dead Man's Millions

One day he interrupted the hearing of a will case to attend to a

The "Kid" Judge and One of the "Kids"

This is Judge Lindsey and his helpers hearing the story of one of the boy offenders. Notice the kindly, interested expression on Judge Lindsey's face.

newsboy, saying: "A live boy is worth more than a dead man's millions."

Through the influence of Miss Jane Addams, Chicago had the first Juvenile Court in the world, but Denver soon followed, and Judge Lindsey became the best known preacher of the new gospel—that "no child can be a criminal."

The "How and Why" of Bad Boys

Making The Boy Over Again

What ails a boy, then, who fights and steals and destroys property and injures others? Judge Lindsey says he is probably neglected and untaught. His father may be dead, his mother obliged to leave him all day to work. He may be willful, or he may have gotten into bad company. He may not have enough to eat, or clothes or books to go to school. He may need some older, wiser person to help him get work, or innocent play, to love him and listen to his troubles. That is what the juvenile court judges and probation officers do for child offenders everywhere, now. They find out why a boy is bad, and then help him to be good.

A Brief Biography of the "Kid" Judge

The "Kid" Judge was born in Tennessee, in 1869. His father, a wealthy planter, was made poor by the war. At eleven years of age he was a "newsie" and messenger boy in Denver. At seventeen, a delicate youth, he had to help his widowed mother care for three younger children. As office boy in a law office he read the big books. He went to

night school and worked his way through college. But he always had a home and a good mother. When he became a judge he saw many boys who had neither.

Isn't 95% Interest in Boys Pretty Good?

Ninety-five out of every hundred children that he put on honor, never got into trouble again. Boys who just couldn't behave he persuaded to go to the reform school. He gave them money and tickets for the journey and they went alone, without guards, asking to be locked up. Once a week there was a confessional in the court room. Each boy made his own confession. No boy was ever asked to tell on another. You know how boys despise a "snitcher." The "kid" judge despises one, too.

Boys Who Liked to be Locked Up

Boys who had not even been arrested came to Judge Lindsey and owned up to law breaking. Stolen things were restored to their owners, and destroyed property paid for through the juvenile court.

Today, hundreds of honest and useful men bless the "kid" Judge for giving them a new start in life, and saving them from the disgrace of having been sent to a reformatory.

The Barefoot Boy

Blessings on thee, little man,
Barefoot boy, with cheek of tan!
With thy turned-up pantaloons,
And thy merry whistled tunes;
With thy red lip, redder still
Kissed by strawberries on the hill;
With the sunshine on thy face,
Through thy torn brim's jaunty grace;
From my heart I give thee joy,—
I was once a barefoot boy!
Prince thou art,—the grown-up man
Only is republican.
Let the million-dollared ride!
Barefoot trudging at his side,
Thou hast more than he can buy
In the reach of ear and eye,
Outward sunshine, inward joy;
Blessings on thee, barefoot boy!

Oh, for boyhood's painless play,
Sleep that wakes in laughing day,
Health that mocks the doctor's rules,
Knowledge never learned of schools,
Of the wild bee's morning chase,
Of the wild-flower's time and place,
Flight of fowl and habitude
Of the tenants of the wood;
How the tortoise bears his shell,
How the woodchuck digs his cell,
And the ground-mole sinks his well;
How the robin feeds her young;
How the oriole's nest is hung.

Oh for boyhood's time of June,
Crowding years in one brief moon,
When all things I heard or saw,
Me, their master, waited for.
I was rich in flowers and trees,
Humming-birds and honey-bees;
For my sport the squirrel played.
Plied the snouted mole his spade;
For my taste the blackberry cone
Purpled over hedge and stone;
Laughed the brook for my delight
Through the day and through the night.
Whispering at the garden wall,
Talked with me from fall to fall;
Mine the sand-rimmed pickerel pond,
Mine the walnut slopes beyond,
Mine, on bending orchard trees,
Apples of Hesperides!
Still as my horizon grew,
Larger grew my riches, too;
All the world I saw or knew
Seemed a complex Chinese toy,
Fashioned for a barefoot boy!

Oh for festal dainties spread,
Like my bowl of milk and bread;
Pewter spoon and bowl of wood,
On the door-stone, gray and rude!
O'er me, like a regal tent,
Cloudy-ribbed, the sunset bent,
Purple-curtained, fringed with gold,
Looped in many a wind-swung fold;
While for music came the play
Of the pied frogs' orchestra;
And, to light the noisy choir,
Lit the fly his lamp of fire.
I was monarch; pomp and joy
Waited on the barefoot boy!

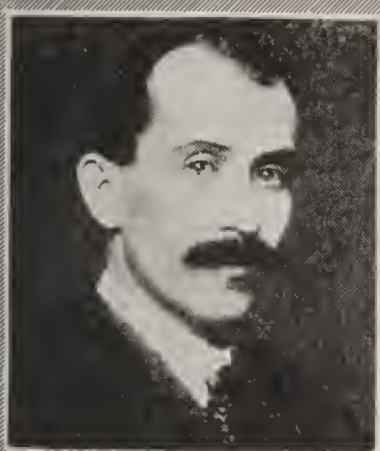
JOHN GREENLEAF WHITTIER

How the Air Man Steers His Way Through the Clouds

Have you ever peeked over the shoulder of the man who was driving an automobile? Or perhaps you have taken the big wheel in your hands yourself and gone spinning over the open roads. Does this look like the front of an automobile? For one thing the wheel is smaller and in the middle instead of at one side. The engine speed-indicator isn't very different from some speedometers. Like the automobile the aeroplane has a clock and a switch and the footbars are something like the automobile's clutch and brake. Many of the ideas in the flying machine have been borrowed from the automobile, you see.

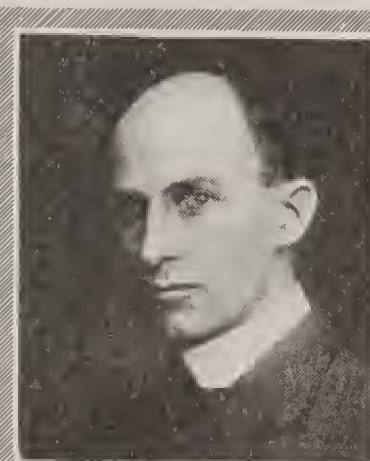
SOME OF THE WORLD'S HELPERS

The Wright Brothers
Conquerors of the Air



Orville Wright, the younger of the two most famous American aviators.

This $2,500 trophy was given by the Scientific American for long distance flights in heavier-than-air machines.



Wilbur Wright who with his brother built the first true flying machine

There is a Wright sister, too. When you think of Wilbur and Orville Wright, the American inventors of the "flying machine," dont forget Katherine Wright, who gave her brothers the money she earned by teaching and nursing, to build their aeroplane.

Now, when anyone does a very big, new thing, the world always wants to know how he came to do it, because that may help other people to do new things. An old man who knew the Wright brothers when they were little chaps has said: "I am not surprised. They were just the kind of boys to do it. Like Edison, they were busy every minute—reading, thinking, learning something even when they played, tinkering at their sleds, kites, bicycles and a printing press. They were gentle mannered boys, honest, modest, truthful, hard working, with active bodies and minds crammed full of curiosity and determination. When they began anything they finished it."

They were neither rich nor poor. Their father was a minister with a large family. They

went through high school and then through his fine library of two thousand good books. The whole family seems to be in this story. The father loved to play and to study with his boys. When Wilbur was eleven and Orville seven years old, he brought home a

Busy Boyhood of the Two Brothers

tried coasting down a steep, snowy hillside on a box kite to see what would happen. Sure enough, it rose from the earth, sailed near the ground a little way and came down —hard.

Putting a Heart in the Mechanical Bird

"I'll tell you what, Buddy," said

The Two "Bird-Men" and Their Sister, Katherine

Underwood & Underwood.

Together these three worked and planned and dreamed to conquer the air. The picture shows them on their return from Europe, where the brothers demonstrated the practicability of their machine.

me-chan-i-cal toy. On being wound up it flew like a bat until it ran down. It was such fun to hunt through big, hard books to find out what made that toy fly. They read about the air-gliding machines of Mr. Otto Lilienthal.

Just like other boys, the Wright brothers had coasted on sleds and bicycles, or earth gliders. They had rowed boats, or water gliders. They had sailed kites, or air gliders. Sometimes, when they had sent up a box kite on a strong wind, it had pulled them off their feet. They

"A Family" That Worked Together

one of them, "if it had an engine in it, it would keep on going."

That wasn't all it needed. In 1896 Mr. Lilienthal was killed when his engine-driven air glider came down so hard that it was wrecked. That made the Wright boys, grown men now, put on their thinking caps in earnest. The motorcycle, motorboat and automobile are all driven by engines, but if they could not be started, stopped and steered they would smash into everything, and be too dangerous.

Learning of Bicycles, Kites and Boats

The aeroplane would be useless until it could be controlled.

What Was Going On in the Bicycle Shop

For the next eight years the Wright brothers spent all their spare time and money working on this problem in their little bicycle shop in Dayton, Ohio. They knew that many other men, in our own country and in Europe, were trying to get the answer to that problem, too. And, oh, they were so much more likely to succeed than the Wright brothers! They had time, learning, delicate testing machines, money to build models, and powerful friends, and even governments to help them, and believe in them. The Wright brothers had only the time after work hours, no money, no laboratory and were not even well educated for their task. No one but sister Katherine and the rest of the family knew what they were trying to do, or believed that they could do it.

How Reading Pointed the Way

One thing kept up their courage.

Caught in a Storm

Storms are fearful things for the aviator. This is a French air man tearing through the wind and rain at the furious rate of one hundred and thirty miles an hour. Can you tell from the picture what type of machine he is using?

By reading of other men's experiments they came to the conclusion that everyone else was on the wrong track. With the rudest tools they made their own tests of air pressure, weight of materials, necessary spread of "wings," engine power, propellers and steering gears. They knew their aeroplane—which was a double box-kite motor-air-boat—would sail before they made it. But if Katherine Wright hadn't given her brothers all her savings they could not have built their aeroplane, and, then, as many people who know, are saying: "We would not be sailing the air today."

It was in December, 1903, at Kitty Hawk, a lonely life-saving station on the coast of North Carolina, that the aeroplane was launched, sailed and brought to earth under perfect control.

A Surprise for the Neighbors

Of course the Wright brothers became rich and famous almost at once. They had kept so quiet about what they were doing that the people of Dayton learned from the

Wild Flying Machines o

Men, before they devised a successful flying machine, learned a great deal from the study of the flight direct imitation of the live "flying machines" were failures. It was only when man worked out the succeeded.

That big word "patagial," under the sectional picture of the African flying squirrel, is simply a scientific such animals as the flying squirrel and the flying lizard.

of birds, insects and other flying creatures. It must be remembered, however, that their attempts to fly by
problem from the standpoint of his own circumstances and the material he had to deal with that he

word meaning "winged membrane." It is applied to the fold of skin connecting the fore and hind legs of

How Men First Tried to Fly

Men first tried to fly by making artificial wings which they operated by waving their arms up and down. This man has two sail-like devices attached to his body like wings, a parachute, and ballast hung from his waist in a basket. It was only after an endless number of such experiments had been tried that they found the right way to sail the air—by copying the kite, not the bird.

Aeroplane Built by the Wright Brothers

The Wright Brothers built the first successful aeroplanes on this model, with two planes, one above and the other below the engine. Behind the planes is the propellor, a big, fan-like wheel, and the rudders, one horizontal, which controls the machine's upward movement and the other perpendicular, for turning it to the right or left. The rubber tired wheels at the bottom are used when the machine rises from the ground and when it lights. When you fly your kite you run very fast with it and if there is a good wind the kite begins to rise. The aeroplane rises in the same way—by running along the ground on its wheels with the horizontal rudder tilted upward. As it begins to go up, straightening this rudder then tilting it again helps it to climb.

newspapers that in their city lived inventors who ranked with Watt, Fulton and Edison.

Money and success did not spoil them. They went right on living in the old frame house with sister Katherine, and their factory is just a big carpenter shop. No one knows which brother deserves the more credit. In speaking of their work they said "we" and "our." Wilbur died in 1912 without telling the secret, and Orville carried the work on alone.

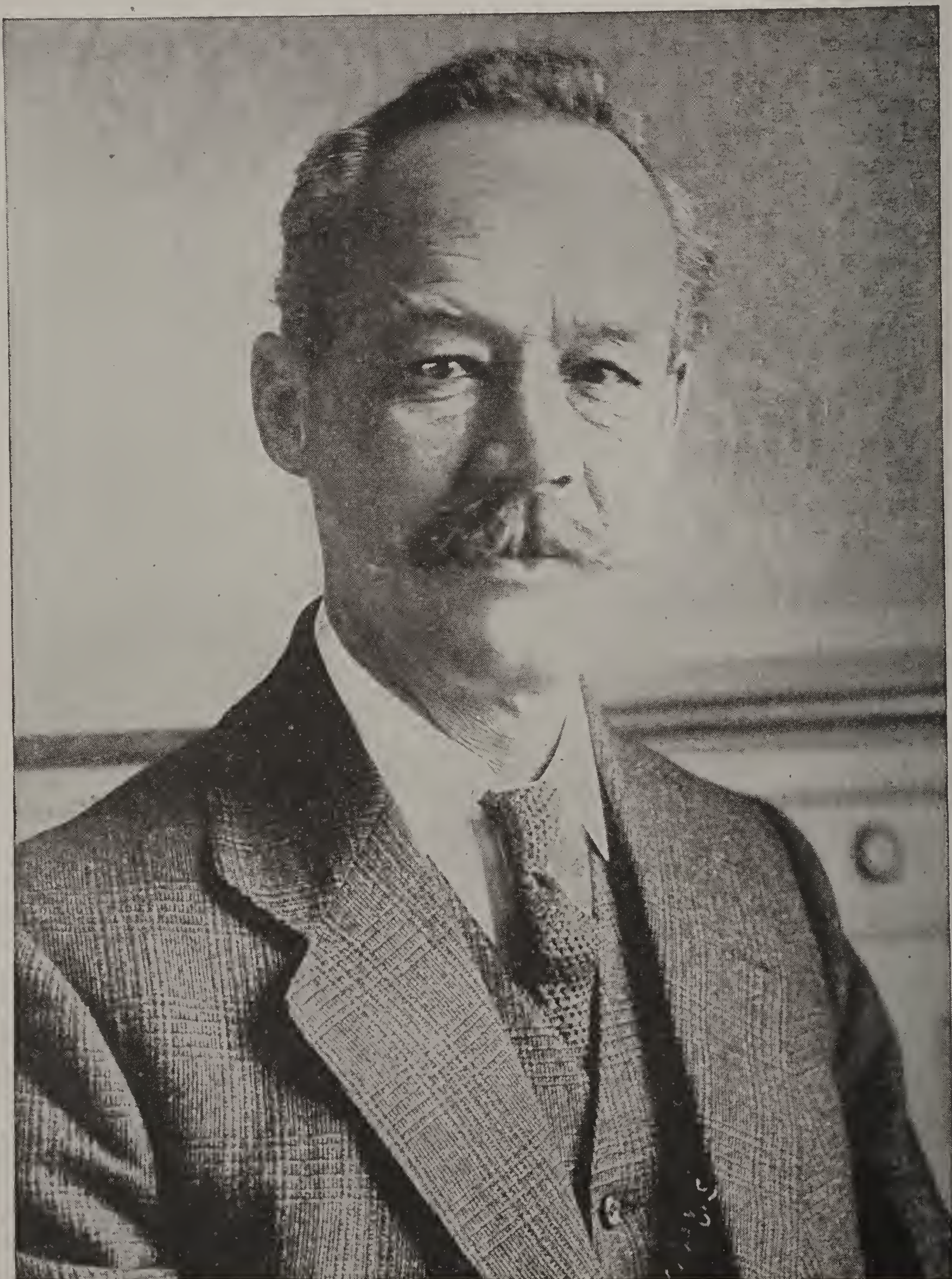
You know how many "bird men" have met death in trying to break speed records, and in feats of skill and daring. The Wright brothers have tried to stop such foolish exhibits. All their efforts, since success, have been toward making the aeroplane safe and useful.

No brighter, cleaner chapter has ever been written in the history of invention than this of the conquest of the air; and we have only a few such stories of brotherly love and loyalty. No other country or time can match this story of two brothers and a sister, working together, under great difficulties and for so long, for a great purpose, with courage, patience and faith.

An Aeroplane's Home on a Boat

Here is a monoplane coming back to the vessel from which it started. The first airships made their starts and landings from the land or from the water itself; it was not until later that they came and went in the air from boats. Now they are sometimes carried by battleships to do scouting.

The Doctor Knight of Labrador



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"He set broken legs, dressed gunshot wounds, cured fever. As a minister he buried the dead, and married the young. He started a traveling library. And he brought Christmas to the children."

THE DOCTOR KNIGHT OF LABRADOR

© Brown Brothers

"People felt better just to see the big, funny bear of a jolly doctor in his Eskimo clothes."

YOU know what a knight is. In old tales of chivalry, the hero put on his armor and rode away to fight bad men and defend fair ladies. After a brave deed he was knighted. The King touched his shoulder with a sword, as he knelt, and said: "Arise, Sir Knight." His title was a sort of hero medal.

Men do not have to fight in that way, today, but they battle against other kinds of evils. They spend their lives in loving service to the poor, the sick, the ignorant and lonely. Painters, sculptors, writers, explorers, men of science, inventors, engineers, help to make the world a better and pleasanter place to live in. In countries where there are kings, men are still being knighted for useful, brave, and kind deeds. A few years ago a medical missionary of far away frozen Labrador knelt before King Edward of England. The King touched his shoulder with a sword and said:

"Soldiers of the Common Good"

"Arise, Sir Wilfred Grenfell."

Then the ladies and gentlemen of the proudest court in the world crowded about a poor doctor of fisher folk, to ask about his dangerous and lonely work. They gave him money to build two hospitals, to buy a swift steam yacht, and to get a herd of reindeer from Lapland, the only milk-giving and big draught animals that can live in Labrador. As an English knight he was able

Winning Friends at the King's Court

to make his mission better known, and to take greater comfort to the people of a desolate land.

Gave Up London for Labrador

Some of the people of Labrador are Eskimos. They can supply their few needs of food, fuel and shelter. But in the fishing villages along the coast there are English and French Canadians. For nine dark months in every year they are frozen in. The ships cannot come and there are no railroads. Doctors and ministers from Newfoundland were afraid to travel with dog sledges. In 1892, news too good to be true spread through the fishing fleets, along three thousand miles of coast, and back to the huts of fur trappers. Dr. Grenfell, a London surgeon, was coming to live and work in Labrador.

In the summer he uses a little steamer, stopping in any harbor where a flag flies. Icebergs, floes, gales, fogs and jutting crags make every voyage perilous. Winter journeys are still more dangerous. At first he had only a spruce log sledge, with the jaw bones of a whale for runners, pulled by a string of Eskimo dogs. There were no roads.

Perils of the Land of Eternal Snow

The Jolly Saint That Dressed Like a Bear

But oh, what things he saw, what suffering he relieved in bare, dark, cold little huts! People felt better just to see the big, furry bear of a jolly doctor in his Eskimo clothes. He set broken legs, dressed gunshot wounds, cured fevers. He got wheeled chairs for the paralyzed; crutches for the crippled. The first wooden leg ever seen in Labrador made a useful man of a helpless boy. Crooked backs and lame hips were cured in the hospitals. Injured fishermen were mended. Herds of reindeer gave milk to children, and made traveling easier.

The First Wooden Leg in Labrador

And He Played Santa Claus, Too!

More than that, he brought joy to cheerless lives. As a minister, he buried the dead, and married the young. He started a traveling library. And he brought Christmas to the children. Magazine and newspaper articles and letters he wrote brought boxes to him from many countries. Boxes of gifts were sent to the most distant cabins. In St. Anthony he dressed as Santa Claus, and drove up to the little village church with a team of reindeer.

What a wonderful, fairy-tale time it was! There were little girls who had never seen a play baby or tea set; boys who had never owned a jackknife or ball; old people who had never eaten candy. No one at all of all those poor fisher folk had ever dreamed of such a glittering tree! Months afterwards he saw one of the Christmas dolls hanging on the wall of a bare hut.

Santa in Reindeer Land

"Why don't you play with your baby doll, dear?" the doctor asked the little mama.

A Doll Too Sweet to Play With!

"Oh, she's too swe-e-et and be-au-ti-ful to hold. I must keep her forever to look at."

If you want to help this brave, true knight keep Christmas, send your gift in the summer. The tiniest thing would make some child happy. Address it to Doctor, Sir Wilfred Grenfell, Battle Harbor, Labrador.

And You Can Help the Doctor

Burbank the Plant Wizard

Photograph by Paul Thompson

This is Luther Burbank himself seated beside a big spineless cactus

ONCE there was a boy who loved plants. Do I mean animals? You can understand any one being fond of *animals,* for they learn to love those who care for them. But any florist, gardener or farmer can tell you that plants repay wise and loving care, by giving their biggest, finest fruits and flowers. Not so very many years ago, people thought in farming and gardening all they could do was to plow land, put in seeds and keep the weeds down. The rest was just weather and luck. So some very useful and beautiful plants dwindled and pined away, because no one knew what more to do for them. Farmers said the seed "ran out." They did nothing about this until a bright boy waked them up.

The Boy Who was "Kind" to Plants

It was in Lancaster, Mass., where Luther Burbank was born in 1849. Most New England boys became sailors—"far countries for to see," or they went to California to dig gold. At sixteen Luther was not strong enough to go to sea, or to "rough it" in a mining camp. He had to stay at home, and do the humdrum tasks of a poor farm. There

The Romance of Farm Life

is no romance in plowing a scanty corn field or digging a meager crop of potatoes—unless you have imagination.

Story of the First Roasting Ears

Two Weeks Ahead of "Luck"

Luther Burbank had. New England seasons are late. There were few green things in the gardens before July. In Fitchburg well-to-do people would pay good prices for early vegetables. He surprised everyone by bringing in a wagon load of "roasting ears," two weeks ahead of anyone else. The secret of it was that he selected large, plump seeds and sprouted them in manure and leaf mold before planting them. His corn was "up" the next morning. He pulled the weaker plants with the weeds, and then plowed and plowed. His corn grew fast and tall, with many ears to the stalk.

The Burbank "White" Blackberry

How He "Invented" His Big Potato

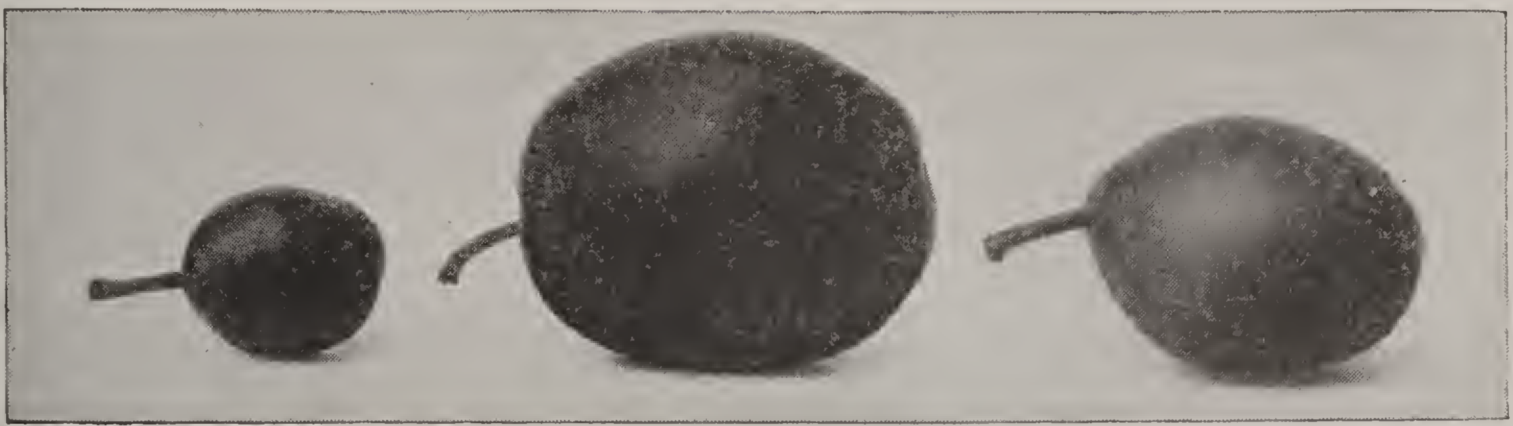
Encouraging Discouraged Potatoes

Next he turned his attention to potatoes. They had "run out" giving only a few small ones in the hill. Poor little discouraged things! He would do his best to help them grow bigger and more plentifully. It took him four summers of back-breaking work, and four long New England winters of patient waiting. But the whole country was excited when the big Burbank potatoes were put on the market for seed. His crop was sold for enough money to take him to southern California, the plant paradise. There, while working as a farm hand, and growing strong in the sun, he studied plants.

How the Wizard Works in His Nursery

Playing the "Honey Bee"

He found that some plants were naturally better than others of the same kind, and *wanted* to be helped. Careful seed selection, rich soil, cultivation, and not allowing bugs to bite them will improve plants wonderfully. But to grow new varieties this plant friend had to play honey bee. He lifted the pollen from the blossom of one kind, on a camel's hair brush, and carried it to the wet button of the seed tube of another. This is called "crossing." By crossing a common red poppy with a red striped yellow one he grew the big, crimson poppy. A way in which he helps fruit is by grafting twig buds of a fine variety that is scarce, onto a vigorous old tree. He has sometimes grafted one thousand varieties of apples on one tree, by cutting out grafts that disappointed him. He works patiently for years, for a cer-



The Big Stoneless Plum and the Two Kinds of Plums from Which It was Developed

tain size, color, flavor or firmness of fruit, or to reduce the seed.

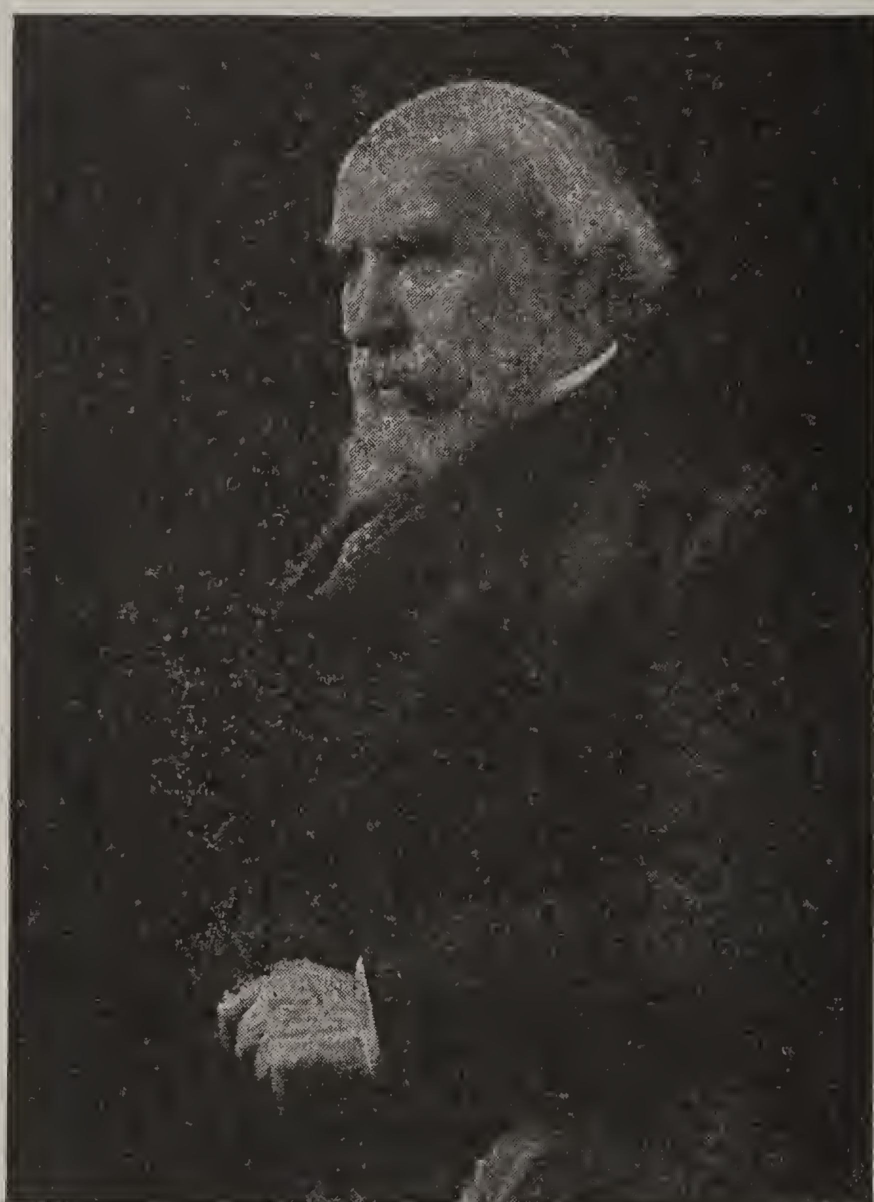
This "plant wizard" as he is called, has no secrets. He tells other men just how he works to get his wonderful results. About forty of his improved plants became known. But he had grown over twelve hundred others that the world knew very little about. You see he had no money to publish reports. As his discoveries were too important to be lost, the Carnegie Institute set aside one hundred thousand dollars to help carry on his experiments. Congress gave him the use of government land on which to grow the spineless cactus that cattle can eat.

Mr. Burbank is not rich, but he has added millions of dollars a year to the value of our field, orchard, garden, forage and timber crops. One of the greatest helpers of men that ever lived, the pathway to his door is worn smooth by pilgrims who go to honor him and learn of him. Don't you wonder if any Lancaster boy who ever went to sea or dug for gold, found greater good fortune, or a happier, more useful life than Luther Burbank found in his corn fields and his hills of "run out" potatoes?

And You Can Find Such Fortunes in Your Cornfield

Burbank's Ever Bearing Rhubarb

Mr. Hill and How He Wrote His Name



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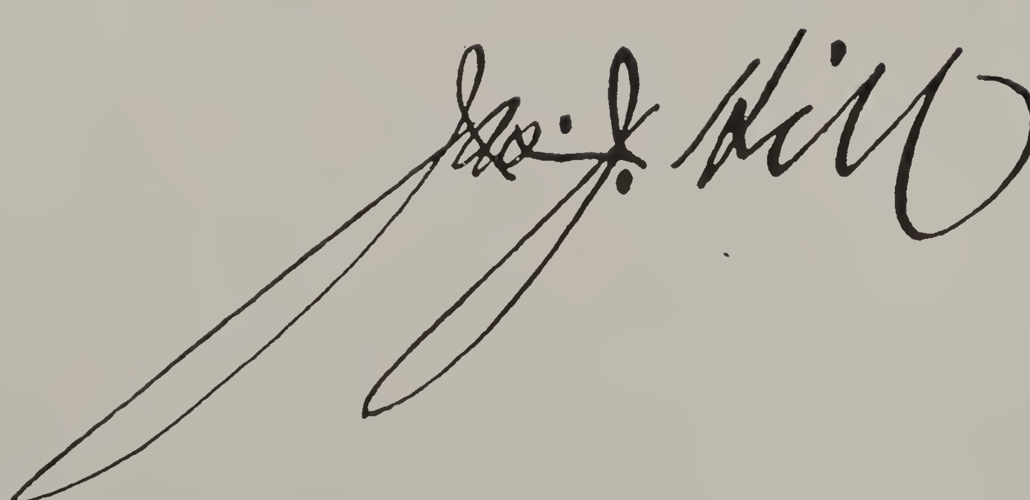


James J. Hill, the Colossus of Roads

Here is Mr. Hill standing in the doorway of the cab of one of his own big locomotives.

IN the story of the "Seven Wonders of the World," you can read about the giant figure of a man that was called the Colossus of Rhodes. When Mr. James J. Hill finished the Great Northern Railroad, some witty person changed the spelling to "roads," to make the name fit our greatest railroad builder.

Little Jim Hill's Fondness for Good Books

Little "Jim" Hill never dreamed of winning such a nickname, when he was a boy on a farm in Ontario, Canada. He had a Scotch mother who wanted her dear, book-loving laddie to be a doctor. When he grew up, and was living in St. Paul, Minnesota, he offered himself as a soldier, to fight in our Civil War, but Uncle Sam could not accept him. Two sad misfortunes, in childhood, spoiled both plans. First a playmate struck him with an arrow, making him blind in one eye, when he was nine years old, so he could not be a soldier. When he was fifteen his father died, and he had to leave

The Studious Hard-Working Scotch Boy

school. In 1856, at the age of eighteen, he came to St. Paul to clerk in a Mississippi River steamboat office. It is a big city today, with a thickly peopled country behind it, but then it was only a struggling pioneer village "at the far end of nowhere." The Scotch Canadian youth worked hard all day, and studied half the night. He learned such a variety of things, and knew them so well, that he could write an encyclopedia. In his railroad building he found use for everything he knew.

They Laughed at First, of Course!

Firewood was cheap in Minnesota, and everybody laughed when "Jim" Hill brought a boat-load of coal from Illinois. But he sent that coal in wagons to the Red River and sold it in the Canadian town of Winnipeg. People laughed again when he bought an unfinished, bankrupt railroad, that had "crawled four hundred miles out on the prairie to die." But in six years, and that was in 1885, he was president of a good road that was making money.

Then Capitalists Began to Believe in Him

In that day, what wheat and lumber came from the Northwest had to go across Canada, by the Canadian Pacific, or down to Chicago by the Northern Pacific. Mr. Hill saw how a thousand miles of rail freight could be saved, if a road were run between these, and Puget Sound connected with Lake Superior. That would save money on the long haul to Buffalo, for water travel is cheaper than land. He made men with money believe in his plan, although neither of the other roads were making profits. Look where the "Great Northern" runs, from Duluth to Seattle, with the cities and towns strung along it. That road was pushed through the wilderness—through "the land of sky blue water" of Minnesota, the prairies of Dakota, along the big muddy Missouri, over wild mountains and deep canyons.

Speaking to a Gathering of Farmers

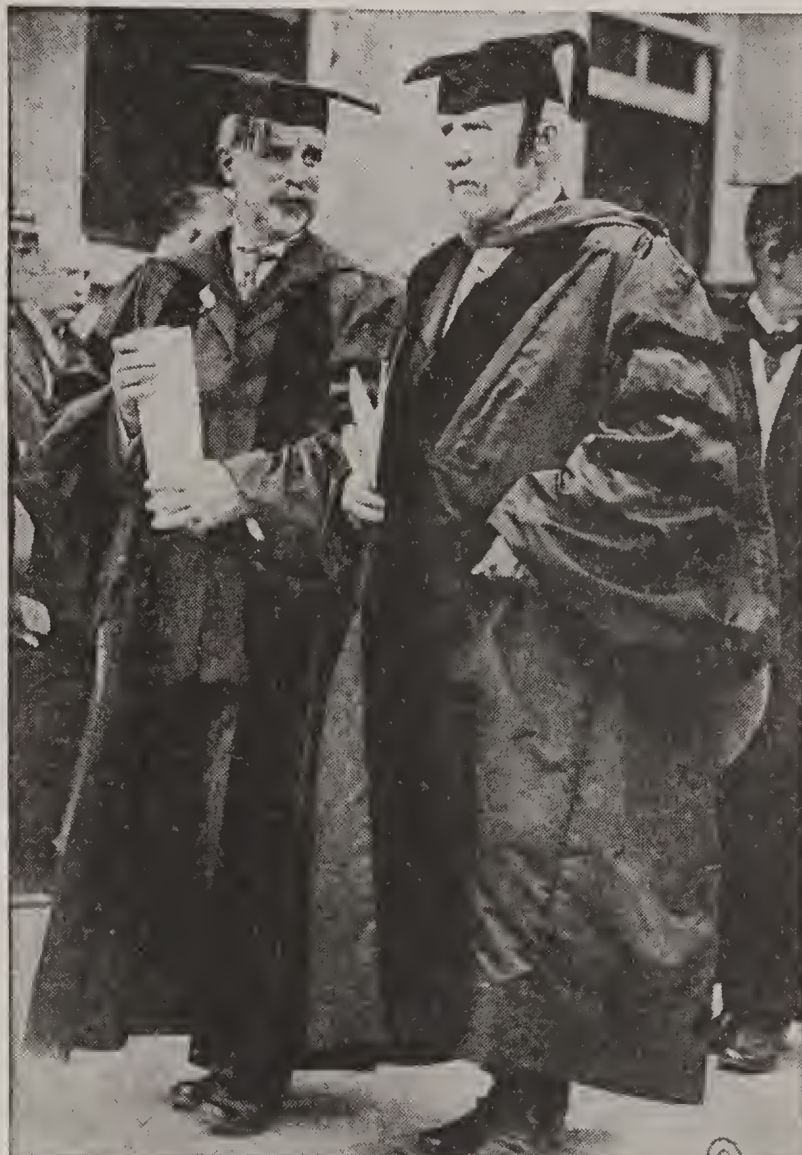
This picture shows Mr. Hill delivering a speech to the farmers along his lines, in which he is emphasizing the need of better farming methods.

A Line that Reached Half Way 'Round the World

When it was finished in 1893, people poured in, and wheat poured out. Lumber camps and mines were opened. Grain elevators rose like lighthouses, above the sea of grain; cattle and sheep ranged a

thousand hills and orchards bloomed in every valley. A fleet of ships had to be built on Lake Superior to carry half a million bushels of wheat to Buffalo every year; and a branch line pushed far up into Canada. There was a fleet on the Pacific to carry flour and cotton to China and Japan, and steamers running to Alaska.

James J. Hill, Scholar and Empire Builder



Above you see Mr. Hill as he looked shortly before receiving an honorary degree from Yale University.

And This Scotch Canadian Boy Did It All

Mr. Hill did it all. He planned the road, got the money, he built the line and he managed it. He put new ideas into railroad and freight vessel building. Low grades, big engines, big cars, big boats, full loads both ways, were ideas that changed losses into profits. He got people to come into his country, and made trade where there was none.

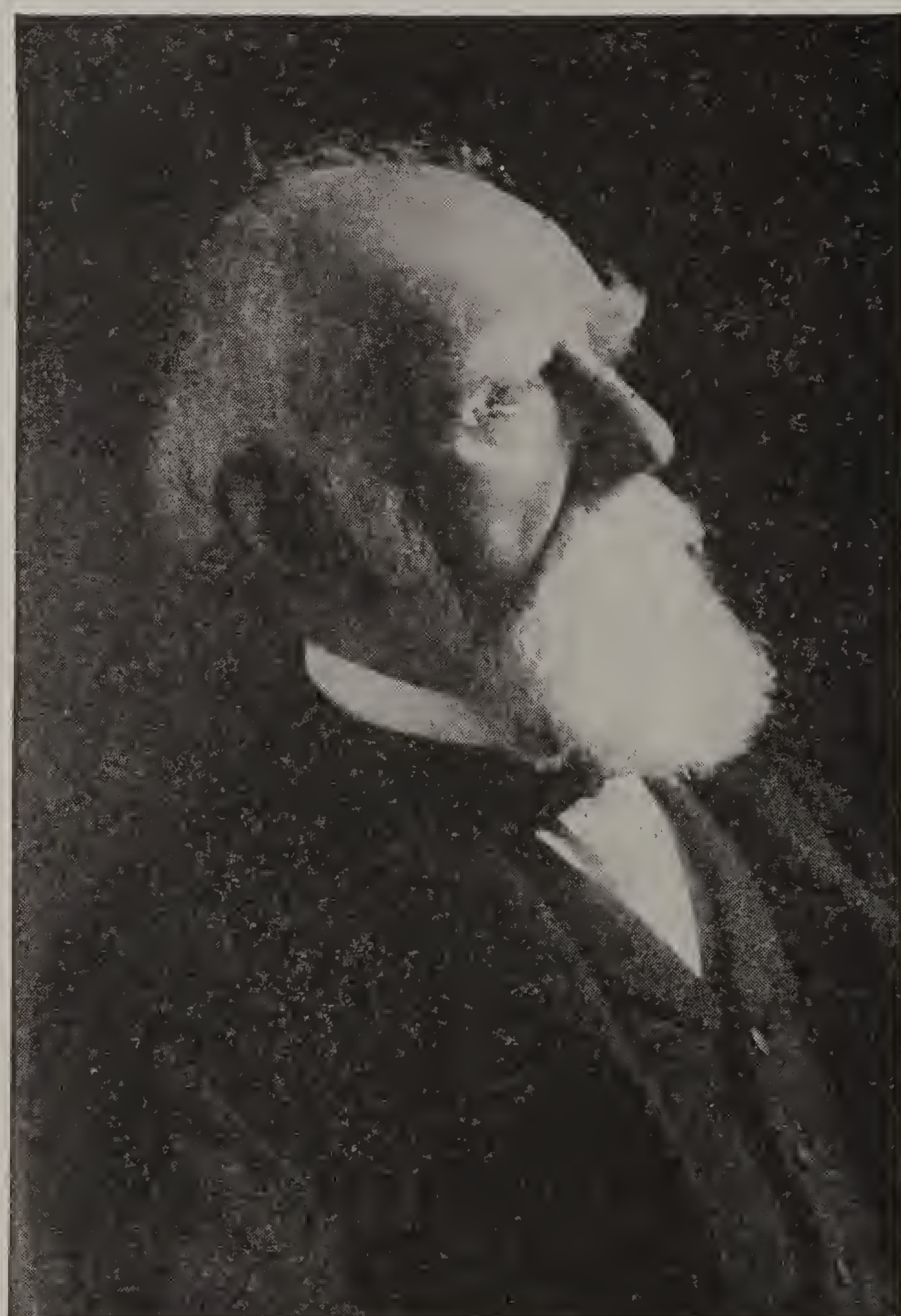
Putting His Geography to Work

He knew every inch of his road—the climate, soil, plants, animals, water, crops and people. He knew every spike and tie, bridge and tunnel and grade. He knew every man he employed. He laid out the town sites. On a model farm he showed others how to grow wheat. He bought blooded animals and improved the live stock. He told people how to market their crops and invest their savings. He kept freight rates as low as possible. In St. Paul he trained young men in his ideas of railroading He trained his own sons to carry on his work.

"James J" Empire Builder

Mr. Hill became one of our richest men, but he made new homes and good livings for millions of people. He added untold wealth to our country, and gave the world more bread to eat. Only a Caesar or Napoleon could show as great a record as he. But military conquerors always destroyed things and then built on the ruins. Mr. Hill tore down nothing. It was a wilderness, a waste empire, that he conquered and built up. Don't you think he deserved his nickname "Colossus of Roads?"

Strathcona, Canada's "Grand Old Man"



"YOU'LL all be proud of my Donald yet."

It's mothers that say such things as that. A certain Mrs. Smith said it at a time when everyone else thought her son was doing something foolish. She was the mother of the little boy who afterward became the great "Lord Strathcona." They lived in a village in the north of Scotland, away back in 1838. Her son wasn't "Lord" anybody then. He was just an eighteen-year old boy named "Donald Alexander Smith." His parents were poor, but Scotch people will educate their children if they have to live on oatmeal and turnips. Donald

Young Donald and the Books

was studying law. Then his uncle John Stewart came home from Canada on a visit, and Donald's whole life was changed.

The Wild Country Back of the Great River

Canada was just as big a place on the map then as it is today, but it wasn't a country under one government. It had cities, towns and farms only along the St. Lawrence River. The rest of it was wilderness. Tribes of Indians and wild animals roamed through the great forests and over the mountains and western plains. White traders lived in the log posts of the Hudson Bay Company to buy furs. These trading forts were hundreds of miles apart. To reach them men had to travel by canoe and dog team.

Donald's uncle was a fur trader. What stories he told of bitter cold and wild flood, of fights with fierce animals, of hunts and camping with the Indians! It was a life of hardship and danger and loneliness, where no man got rich or was ever heard of outside. But Donald wanted to go.

"Driving the Golden Spike"

It was fitting that Donald Smith, later to be Lord Strathcona, should drive the last spike in the rails of the Canadian Pacific Railroad he had worked so hard to build. By connecting the St. Lawrence cities with the Pacific, this railroad has done much for the development of Canada.

When Donald Went Away

His mother was sick and sad at heart. Perhaps she thought him foolish, too, but she said: "My son

is good, and he has an old head. He will work hard and be honest, faithful and brave. You'll all be proud of my Donald yet."

He became a clerk for the fur trading company and was sent to Labrador. That part of Canada is still called "the back door to the North Pole." When Donald went there many Eskimos and polar bears lived along its pitiless shores. He was paid only $100 for the first year's work. He had a log cabin, goods to trade with the Indians, and for food, flour, pork and beans. Only twice a year could he get letters. He had to teach the stupid Indians how to hunt. He brought comfort and hope to them and made trade where there had been none. No day was too bitter, no journey or winter too long, no task too hard for Donald Smith. The Indians called him "Spirit-of-Iron."

A Neighbor of the Polar Bear

In the thirteen years that he stayed in Labrador and in posts around Hudson Bay, he had time to read and write and think and hold his tongue, to face dangers unafraid and to hold to his purpose. In his old age he was strong and tireless, fearless and silent, and he finished every task he undertook. For thirty years altogether, he was a fur trader in the wilderness, but he climbed. Wherever he went he ruled his little or big post wisely, increased trade and dealt justly with the poor Indians and white trappers. At forty-eight he was chief officer of the Hudson Bay Company, commanding an army of traders in distant posts, from Montreal.

A Man Who Stuck to His Purpose

In 1867 "The Dominion of Canada" was formed out of the provinces along the St. Lawrence. The new government then bought large territories in the Northwest from the Hudson Bay Company. The fur traders on the Red River, now Manitoba, did not like this and some of them rebelled. Donald Smith went among them. He was made a prisoner, but he got them to give up without fighting. He knew that the fur company must move to wilder lands and give up all the country that could be used for farms and cities. But settlers would not come without railroads. So he joined Mr. J. J. Hill of St. Paul, Minnesota, in pushing a railroad up to Winnipeg.

Donald Made a Prisoner

He saw, too, that if Canada was ever to be a big nation, with many people in it, and all its parts bound together, it must have a railway from Montreal to the Pacific Coast. So he set himself the task of building the Canadian Pacific Railroad. He did for Canada what Mr. Hill did for the United States in building the Great Northern Railroad. It was his pluck, his tireless work, his honesty, his patriotism, his "spirit of iron" that did it. The task was fifteen years long. When it was done he was called to London to be made Governor of the Hudson Bay Company, and to be knighted by the Queen. He was also Lord High Commissioner for Canada—a sort of ambassador. His railroad made him rich. In 1897, he was made Baron Strathcona and Mount Royal of Scotland and Canada.

Then They Made Him a Knight

His mother knew him. The whole British Empire became proud of her Donald. Indians and fur traders, his company, his friends, his adopted country found him equal to every task. Faithful in little things he was able to do all the big ones.

John Burroughs, Prophet of Nature

"Come forth into the light of things,
Let Nature be your teacher."

WORDSWORTH

THIS is the story of a man who was born on a farm. And when he grew up and could have become a rich banker, he went back to a farm. Other things were more important and interesting to him than making money. Guess what they were. Birds, for one thing; squirrels, rabbits, wild bees; sunshine and storm; mountains, woods and water; rocks, and oh—all out-of-doors, and being alive and well, and untroubled, and having time to think beautiful thoughts and to write them down for people to read

What Kept John Burroughs Busy

When Mr. Burroughs Was a Little Boy

Perhaps this isn't so strange, after all. In Roxbury, New York, some one was sure to be born who would feel like that. It lay west of the wild, romantic Catskill Mountains, where Rip Van Winkle had his strange adventure. What a boyhood his was! One of

In the Romantic Catskills

those dear, barefooted, "little brown hands" boys.

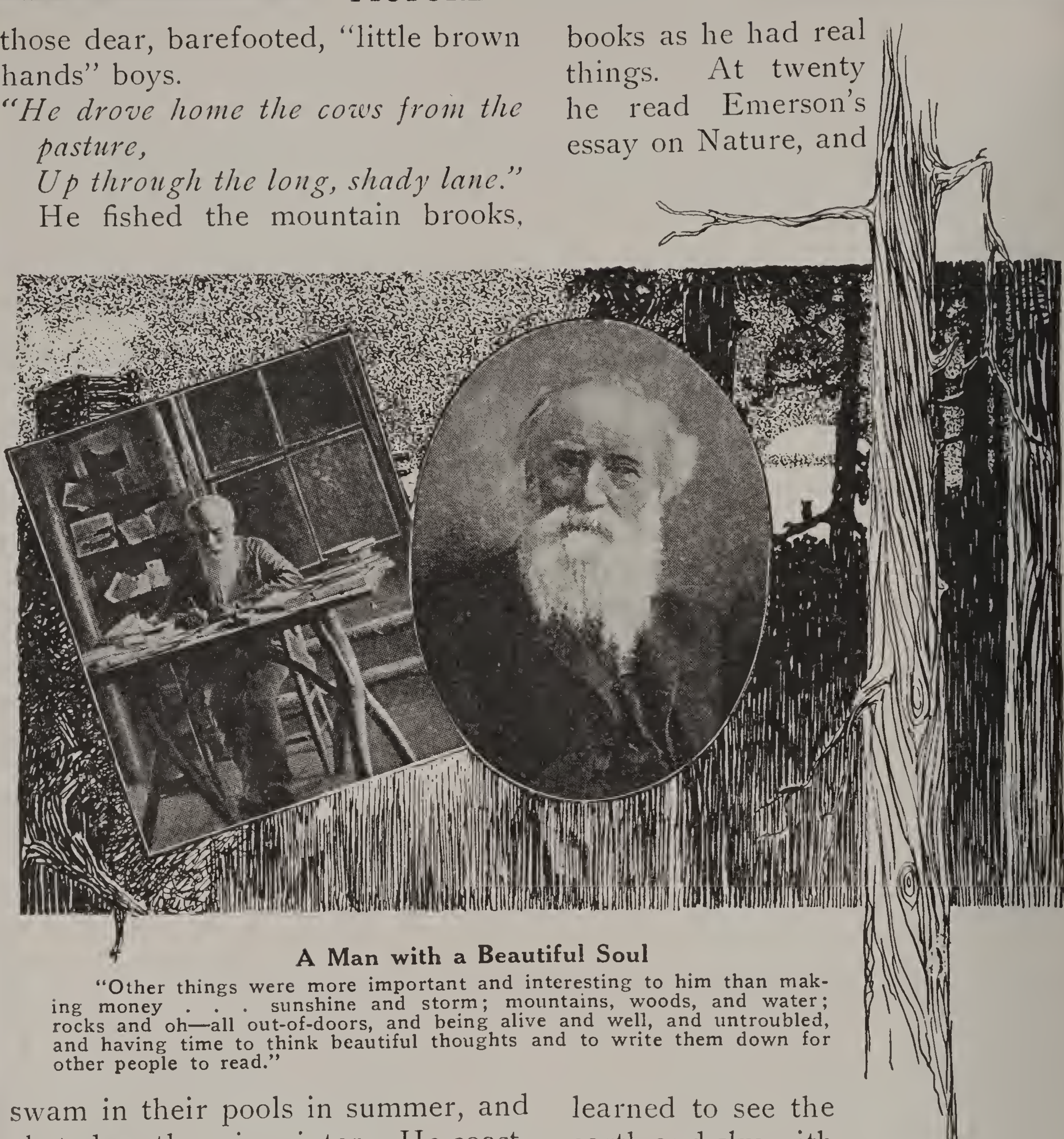
"He drove home the cows from the pasture,
Up through the long, shady lane."

He fished the mountain brooks, swam in their pools in summer, and skated on them in winter. He coasted on the snow-clad hills, and fought merry, snowball battles. He knew the fox's dens, the blue-bird's nest, the song of the brown thrush. He and the squirrels went nutting in the same deep glens. He and the robins ate from the same scarlet feast of wood strawberries, and the wild bees shared their stores of sumac honey with him.

Nutting with the Squirrels

The Book of Nature and the Books at School

He went to the village school and academy, but he had not so many books as he had real things. At twenty he read Emerson's essay on Nature, and learned to see the earth and sky with the eye and mind and heart of a poet. At twenty-three, and that was in 1860, he wrote an essay that was printed in the *Atlantic Monthly*.



A Man with a Beautiful Soul

"Other things were more important and interesting to him than making money . . . sunshine and storm; mountains, woods, and water; rocks and oh—all out-of-doors, and being alive and well, and untroubled, and having time to think beautiful thoughts and to write them down for other people to read."

Then he had to do many things to make a living. He taught school, worked on newspapers, and was a government clerk in Washington. He was trusted so, and knew so much about banking that he was made bank examiner and receiver of a failed bank. If he had opened a bank himself, many people would have hurried to put their money in

it. But, you see, he cared more about a lovely Nature book that he had written—"Wake Robin." "Birds and Poets," and "Winter Sunshine." And his books got him a nickname: "John o'Birds."

Yale University conferred the honorary degree of Doctor of Letters upon John Burroughs in 1910. Here we see him in his Doctor's robe, just after receiving the degree.

The Beautiful "Land of Esopus"

Having bought some half wild land at Esopus, New York, between the Hudson and the Catskills, he planted a fertile field with celery and a rough hillside with grape vines. These would make enough for his family to live on, and give him leisure for writing. "I planted myself with my vines," he said, "and left room for the birds and squirrels." But it was from the scenery that he got his richest harvest. The rocky gorge, the forests, the ruined mill and rustic bridge, the views of mountains and river, and all the wild creatures have inspired a dozen books with such dear titles as

Harvesting the Scenery

John Burroughs in His Woods

He lives in a gray and brown stone and shingle house that looks, inside and out, like a nest. His study room, called "Slabsides," is a single square room, faced with mill slabs, bowered in vines, like the trunk of an old tree. Birds and bees and wasps and butterflies go in and out of the open windows. The squirrels come to the sills for grain and nuts. There the nature writer watches spring come up through the woods and the snow storm draw its veil over river and mountain. He writes of nothing but what he sees and thinks and feels, and in homely, rugged words. He is not a great natural-

Where All Nature is at Home

A Reporter of "All Out Doors"

ist, but he is a very fine poetic one. He calls himself the watcher and reporter of woods and fields, of earth and sky. We know that he tells us only what is true and beautiful, and he tells it in such a way as to make us love all out-of-doors with him.

Aren't you glad John o'Birds had no time to get rich?

All Things Beautiful

All things bright and beautiful,
All creatures great and small,
All things wise and wonderful,
The Lord God made them all.

Each little flower that opens,
Each little bird that sings,
He made their glowing colors,
He made their tiny wings.

The purple-headed mountain,
The river, running by,
The morning and the sunset,
That lighteth up the sky.

The tall trees in the greenwood,
The pleasant summer sun,
The ripe fruits in the garden,
He made them every one.

He gave us eyes to see them,
And lips that we might tell,
How great is God Almighty,
Who hath made all things so well.

—Cecil F. Alexander

SOME OF THE WORLD'S HELPERS

Wizard Edison and His Work

Thomas A Edison

© Harper & Bros.

The Boy, the Father of the Man

It is rarely that we see such a striking resemblance between a boy of twelve and the same boy at sixty-eight. It is said that genius is simply boyish enthusiasm carried through one's whole life work—and the life of Edison is a striking example.

IT'S hard to think of a great man as having once been a little boy, with a little boy's naughtiness and dearnesses, and a nickname, isn't it? What do you thing his mother called the great inventor when he was her little boy?

"Sobersides!"

This is "Little Mr. Sobersides"

She said he was a serious baby. He seldom laughed, because he was too busy. He watched everything with big, gray, wondering eyes, and he asked her millions of questions that she could not answer. A sturdy, active little fellow, his idea of fun was to get so interested in doing something that he had to be told when he was hungry and sleepy. His father had a shingle mill in Milan, Ohio, where he was born in 1847, and there was a canal

The Busy Boy who Forgot to Get Hungry

and wharves, crowded with grain boats and farm wagons. In Port Huron, Mich., there was a public library. Wanting to know everything in the world, little Sobersides thought he would read all the books. He soon saw that was too big a job. At twelve he was doing a rushing business as a train boy. But he found time to print a little newspaper, to set up a laboratory for experimenting, in the smoking car, railway station in Canada. There he experimented on sending more than one message at a time, and on a "repeater" that would take down the dots and dashes. Such a shabby boy! He spent his money on electrical books and instruments. At twenty-one in New York, he repaired a "ticker" (ask papa what a "ticker" is) in Wall Street. Inventing an improved "ticker," he got $40,000

Invention of the "Ticker."

THE FIRST TIME THE PHONOGRAPH TALKED

© Harper & Bros.

No fond parent ever heard the earliest lispings of his baby with more delight than did Edison the first words from his phonograph. The picture shows him listening to its first speech after five sleepless days and nights perfecting it.

and to save the life of a station agent's baby. The grateful agent taught him how to send telegrams.

"How Does It Work?" Said Alva

"How does it work?" Alva asked.

"I don't know," answered the agent. "You get up your speed to take messages as fast as anyone can send them. That's all you need to know."

Finding "How the Wheels Go Round"

"That's easy. But I've got to know *how* it goes." So he worked on an old battery in the cellar until he understood.

At fifteen he was in charge of a

for it, and another nickname—"The Boy Wonder of Wall Street." He also got a factory built by the Western Union Telegraph Company, and a big salary to put in all his time inventing.

"What's the Time?" "Time to Work!"

"I owe my success," he once said, "to the fact that I never had a clock in my work room." And would you believe it? There was not a clock in the factory! Three hundred men worked as he did. Ah, what a workshop! A chemical laboratory, a library, a private secre-

How Work Makes "Wizards"

tary, a bookkeeper, a patent attorney to file papers in Washington,—flying belts and wheels and lathes all run by electric power! There, in old clothes, with acid stained hands, and blinking like an owl if spoken to, "Sobersides" worked. Fifty inventions were going at once. At thirty he had a larger factory and had got another nickname—"The Wizard of Menlo Park." Ten years later he had his enormous plant at Orange, New Jersey. Year after year he worked out his many wonderful electrical inventions.

What Mr. Edison Said About "Genius"

How to Be a "Born" Inventor

"Oh, yes," you think, "but Edison was a born inventor. It was easy for him." If you know the story of the incandescent lamp you know how long he worked, how many years and dollars he spent to give us the light that we turn on by pushing the button. And people laughed at him when he said he was going to make an incandescent, electric lamp in a closed glass bulb. But after a while they stopped laughing, and thought "the wizard" could do anything. He invented the "talking machine," called the phonograph; the megaphone or sound magnifier that magnifies a shout on ball fields and at railway stations. Then they laughed when he said he was going to build a big house in a week by pouring concrete into iron moulds! And he did it, as you see from the picture.

A "Happy Boy" in Old Age

It is hard to be laughed at, you know. But Edison was too busy to pay any attention to the people who, at first, made fun of him. His electric lamp alone made him rich and famous enough for one man. But he went right on working as hard as ever; ate when he was hungry, slept when tired and was as happy as a boy at a ball game.

This statue, which you have already seen in Mr. Edison's library along with his dictaphone and a model of his concrete house, is by the Italian sculptor, Brodiga, and represents the triumph of Electricity over Gas.

Locating the South Pole

In order to become an explorer, Captain Amundsen had to study astronomy. In the picture he is using the sextant to measure the length of the arc between two stars. From this he calculated the position of the sun and his own location on the earth's surface. The observation is being made during a halt in the march. One of his comrades is noting down the reports that he makes while the dogs are taking a rest in the harness and seemingly watching proceedings with interest.

How "Roald" Wrote His Name On Both Ends of the Earth

Here is Captain Roald Amundsen with four of his crew, on board the *Fram*, the ship upon which he sailed on his journey to the South Pole.

A Hero Who Dropped Out of the Sky

HOW would you like to live in a gold mining town, away up on the Arctic Circle, in Alaska—a town of low, log houses, strung along the bank of the Yukon River? And then, when you were all out skating, on a short, dark December day, to have a real hero drop from the sky? That is what happened at Eagle City in 1905. The hero was a blue-eyed blond giant over six feet tall. He was dressed in yellow seal skins, and he drove a string of yapping Eskimo dogs. Down the frozen flood his dog-team raced from the Canadian Rockies that towered to the clouds.

The Name on the Register

"Captain Roald Amundsen of the steamship *Gjoa,* Christiania, Norway," he wrote in the hotel register. Everyone crowded around him.

Only Seven Hundred Miles in the Arctics!

"We heard you were lost. Where's your ship? How did you get through? From the Mackenzie River! Seven hundred miles over mountains, in the dead of arctic winter!" "Haven't got a frost bitten toe, nor lost a good

dog," the blond giant laughed.

What a story for boys and girls to hear from a modern viking! He had done what your school histories tell you Sebastian Cabot tried to do in 1497, and what many trained explorers and brave whalers had tried to do since.

Like a Man Stepped Out of History

He had found the Northwest Passage, and taken a vessel through it, from Hudson Bay to the mouth of the Mackenzie River.

It was not luck. No difficult thing has ever been done in that way. At the age of fourteen the Danish Norwegian boy went to sea to be a sailor.

Brave Ambition of a Boy

At the age of twenty-five he was chosen for his strength, skill, honesty and keen mind, as one of a small company of explorers that tried to reach the South Pole. On his return from the expedition he sought the friendship and advice of Dr. Nansen, to learn what he had to do in order to become a successful explorer of polar regions.

Years of study were needed for such an undertaking; a good boat, a picked company of men and money to buy supplies for several years. In six years Amundsen had the knowledge. But he had money only for a sixty-ton boat, and supplies for eight men. Buying dogs in Greenland, in June, 1903, he sailed westward.

In Six Years He "Passed"

Except that his boat was reported "crushed in the ice," nothing more was heard of him until he anchored the *Gjoa* among the whaling fleet at Herschell Island. There he left it in the ice, and made the perilous journey overland, with a dog team and a whaling captain.

The Discoverers of the Poles

The fine, soldierly-looking man at the left is Admiral Robert E. Peary, the intrepid American explorer who discovered the North Pole. Captain Roald Amundsen, who discovered the South Pole, is standing at the right.

At thirty-five Captain Amundsen was famous. His book and lectures would have made him rich. But, having another task to do, he shut himself up with his books. The world had almost forgotten him when, in 1910, he headed an exploring party to find the South Pole. He steamed away on the famous ship *Fram* that Dr. Nansen had taken farthest north. It was in October, 1911, when the seal and

seabirds had come to land, in the southern spring, that Captain Amundsen left his winter quarters, for the eight hundred and seventy-five mile march to the pole. He had five men, four sledges, fifty-two dogs and food for four months. He had to cross a wide glacier, climb a steep mountain wall and traverse a plateau two miles high. It was ten degrees below zero, and the polar plains were swept by wintry gales.

The Great Dash for the Pole

"December fourteenth when we reached the pole, and a beautiful day, bright and cold," he wrote in his diary. "We named the plateau King Haakon Land. We raised a tent that we called Polheim (Polar Home), planted and saluted the Norwegian flag, and floated the pennant of the *Fram*—Good old *Fram!* She has gone farthest north and south. We returned to camp in thirty-nine days, almost fat, and with eleven dogs that turned up their noses at frozen seal meat."

Planting the Flag at the Pole

A Second Discoverer of the South Pole

Captain Amundsen had captured the last prize of exploration. He had been home several months when he gladly shared the glory with another man—a man who had failed and died, where he had succeeded and lived. Captain Scott of the English exploration party, had reached the South Pole too, a little later than Amundsen, but had perished on the return journey in a blizzard. In his records he gave Amundsen the honor of reaching the pole first. Both explorers proved to the world that no deed is as great as the brave man who dares to do it; that honor is higher than honors, and that there is human courage that no fate can daunt.

Sad Fate of Brave Captain Scott

The South Polar Regions

The ship drove fast, loud roared the blast,
And southward aye we fled.

And now there came both mist and snow,
And it grew wondrous cold:
And ice, mast-high, came floating by,
As green as emerald.

And through the drifts the snowy clifts
Did send a dismal sheen:
Nor shapes of men nor beasts we ken—
The ice was all between.

The ice was here, the ice was there,
The ice was all around:
It cracked and growled, and roared and howled,
Like noises in a swound!

—SAMUEL TAYLOR COLERIDGE

The Angel of the Battle Field

© Brown Brothers

"For Herself, She Was as Timid as a Mouse, for Others, as Brave as a Lion."

ONCE there was a very little girl, and that means one who was undersized for her age. When she spoke she "lithped," which, you know, is about the "thweeteth" thing any little girl can do; but it embarrassed her very much. She was too bashful to ask for enough to eat or to tell her mama when her Sunday gloves were worn out. She cried herself sick over a funny mistake she made in pronouncing a word. When she grew up and taught school, the dear little children scared her.

But She Was Not Afraid of Battles

So, what do you suppose she did? Run away and live alone? No. She went right out on dreadful battlefields, and stood behind roaring cannon. She cared for

wounded soldiers. Many a time she had to climb on a trooper's horse and fly for her life, with bullets pattering about her like hail. For fifty years she lived amid scenes of suffering and death. You see, for herself she was as timid as a mouse; but for others, as brave as a lion.

Timid for Herself, Fearless for Others

The Girl Who Was Born on Christmas

This little girl was Clara Barton, first president of the American Red Cross Society. She was born in Oxford, Massachusetts, on Christmas day of 1830. Babies born in that cold winter were called snow birds. Her two brothers and sisters were grown up, when she came, so she had no young playmates; but one brother taught her to ride the wild colts on the farm. A horse was one thing of which she was never afraid. She was a "Tomboy," too, when no one was looking. She skated with boys, climbed trees and jumped from the haymow. She loved animals and had chickens, turkeys, geese, ducks, dogs, cats and canary birds for pets. She was such a darling of a teacher, and the children loved her so, that she built up a school of six hundred pupils, in Bordentown, New Jersey. Then she went to be a clerk in a patent office at Washington. She read in the newspapers about Miss Florence Nightingale nursing the soldiers in the far away Crimean War.

"Boyhood" of Clara Barton

An American Florence Nightingale

When our own Civil War began, in 1860, she offered to do field nursing. Soon she was managing hospitals and other nurses. Before the end of the war General Butler made her "The Lady in Charge" of the military hospitals. Then, by President Lincoln's order, she searched hospitals, prisons and battle grounds, to find missing soldiers, get those who were living, home again, and mark the graves of the dead. In 1870 she went abroad and did field work in the Franco-German war, and fed the starving in Paris, after the long seige.

"The Lady in Charge"

In 1881 she organized the American Red Cross Society and was elected its first president. For a quarter of a century after that she went wherever there was suffering to relieve—after battle, fire, flood, earthquake and yellow fever. But she never got over being timid. When eighty years old and of world-wide fame, she said:

Organizing the American Red Cross

"It makes shivers go up and down my spine to address a meeting."

Don't you wish there were more brave little scared girls like dear Clara Barton?

When War Shall Be No More

Down the dark future, through long generations,
The echoing sounds grow fainter and then cease;
And like a bell, with solemn, sweet vibrations,
I hear once more the voice of Christ say, "Peace!"

Peace! and no longer from its brazen portals
The blast of War's great organ shakes the skies!
But beautiful as songs of the immortals,
The holy melodies of love arise.

H. W. Longfellow

The Little Girl Who Discovered America

"I was born in the Middle Ages of ignorance, fear, and cruelty. And I have grown up in this modern world of freedom, light, and hope."

YES, I know, Columbus discovered America—the first time. But every colony that came to our new land found it again, and to each one it meant something different. To the Spanish, it meant conquest and gold mines. To the French, it meant adventure and missionary work in the wilderness. To the English, it meant new homes in a free land. And did you ever think that every foreigner who comes to us today discovers America all over again?

At the Door Marked "Push"

At the immigrant station in Boston harbor, there is a door with these words on it: "Push: to Boston." Some days it swings all day long to let in newcomers. One day, nearly four hundred years after Columbus, a little Russian Jewish girl of eleven, pushed that door open. Her dark eyes sparkled; her body quivered with happiness. Her name was Mary Antin.

"Father," she whispered, "can

no one throw mud at us? Or spit in our faces? Or soldiers push us back with guns? Or mobs break into our houses to kill and steal and burn?"

"No, Mary, none of these things will be done to us in America."

"And we can go to school without paying—even girls?"

"Yes, little one."

"Oh, dear mother, America's the 'Promised Land' of the Hebrews!" And Mary whirled her brothers and sisters in a gay dance, on the boat landing. A policeman on the corner smiled at her.

You would have thought America a land of misery and terror, had you been in Mary's place. The family was wretchedly poor, and went to live in the slums of Boston. And Mary could remember when they had been well-to-do; they were even considered rich by their Russian neighbors. In Polotzk, Russia, where she was born in 1872, the mother had had a fine shop. The father had been educated for a Rabbi, or Jewish priest. Now the scholar turned peddlar, or ran a little peanut stand on the beach. Sometimes there was not enough to eat, or money for the rent in an old tenement. The only playground was a sidewalk.

But they were free and unafraid. They did not have to live "within the pale" or Jewish quarter. They were not insulted or threatened. A mob destroyed their home and shop in Russia. Stripped of all their property they had fled to America.

That Glorious Place, the School

It was a wonderful September morning when Mary first went to school. Their father led the five children, as though he were taking them to a religious ceremony in the synagogue. The schoolhouse was a palace with gentle princesses for teachers. At eleven, Mary learned to read. At the end of a year she was in the fourth grade. In three years she finished the grammar school, and went to the Boston Latin School. When there was no money, a Russian Jew who kept a tiny grocery in a basement, filled the little scholar's glass lamp with oil. He let her have writing paper on credit. But he had no stamps. Sometimes Mary could not mail a letter at once. When she was sixteen she got a good many letters, from important Americans, for she had written a little book, in Yiddish, telling the story of her life. It was translated into English.

The Palace and the Princess

When she read American history, Mary wished she had lived here in Revolutionary days to fight for liberty. But there was nothing left to fight for. Her American schoolmates told her so. When she grew older she learned that this was not true. The country had changed. In Washington's time there were no big cities. No one was very rich or poor. Now, there are many new evils to be fought—poverty, disease, ignorance, vice, dishonesty in our public service. And sympathy and brotherhood must be widened to take in all the aliens who come to our shores.

At seventeen, Mary married Mr. A. W. Grabau, a professor in Columbia University, and a Gentile. Then she entered Barnard College. She had a little American daughter to love, and many friends. She lifted her family above poverty. Then she wrote a book that she called "The Promised Land," her name for the United States.

Mary's Promised Land

How Love Brought Light to Blind Helen Keller

Miss Keller can enjoy sculpture better than any other form of art. The lines of the figures speak to her hands, revealing the thought of the artist, as truly as to our eyes. She reads character with her hands, too. She says the only sure way to judge a man is by his handclasp because we control our faces, hide our thoughts and check our speech, but we cannot change our hands.

In Darkness and Silence

The most dreadful imprisonment in the world is to be shut up alone, in a dark and silent cell. But no prison is as black and hopeless as blindness, as still as deafness. You would not think that a tiny girl who was both deaf and blind could ever break out of such dreary loneliness into our world of work and play, would you? It is because she did this, that Helen Keller's story is one of the most wonderful that ever can be told.

And Once She Could See and Hear!

When she was born in Tuscumbia, Alabama, in 1880, Helen's bright eyes saw the blue sky, the birds, bees and flowers of that sunny, southern land. Her baby ears heard her mother's tender voice and the songs of the birds.

She could talk a little when a year old. Then scarlet fever made her deaf and blind. The only way the poor baby could know that she was not alone in a black and soundless world was to cling to her mother. Her voice was not gone, but she soon forgot what words she knew. She nodded her head for "yes." When cold she shivered. When hungry she pretended to spread butter on bread. She learned that her mother could call others by moving her lips. Helen moved her lips, too, but no one understood her. This made her very unhappy. Sometimes, when her queer signs were not understood, she cried herself to sleep in her mother's arms. Sometimes she kicked and screamed, in such terrible fits of anger that her parents feared she would lose her mind.

Then Came the Dreadful Fever

Everything possible was done to make her happier. She had a jolly little dog. A colored child took her hand and ran with her to hunt eggs. She could gather flowers, grind coffee, turn the ice-cream freezer, string beads, pump water and feed the chickens. Then a new sister came. She loved to hold the soft, cuddly body, until she learned that even the helpless baby could call "mother." At last Miss Anne Sullivan, a teacher of blind children, came to see if she could teach Helen. She came when Helen was six, and loved the little girl so that she never left her.

Miss Sullivan gave Helen a doll. Into her hand she spelled d-o-l-l, in the deaf and dumb alphabet. She spelled other words, but Helen did not understand what she was trying to do. One day when Helen was pumping, the teacher put her hand in the stream, and then spelled w-a-t-e-r.

All at once she understood. This was the sign for "water." "What is this, and this, and this?" She wanted to know the signs for everything. Oh, how happy she was! She could hardly sleep nights. She wanted to talk to this dear new friend and ask a thousand questions. She had a quick and eager mind. When the one window to it—the window of touch—was opened, the whole glad world poured in. She learned to read with the raised let-

Joyous Message the Signs Brought

Two World Helpers Together

Here is blind Helen Keller talking in hand-language to Joseph Jefferson, the famous actor, who was known all over the world for his impersonation of Rip Van Winkle.

ter books of the blind. She learned to speak, by touching the teacher's lips and throat. She could not hear her own voice, but she knew others heard. Her dog ran to her when she called "Belle!" Her little sister's arms went around her neck when she said: "I love you."

How Helen Went to College

When she grew up she went to college. It cost a great deal; all her books had to be printed in raised letters. She had to have a special typewriter. Her teacher had to go, too, to repeat questions, and report lectures by talking into her hand. Her parents were not rich people. A wealthy man paid for everything. She took the full course at Radcliffe, the Girl's College at Harvard University. Then she was given a lovely home, and money to live on, with her teacher.

Finger "Listening" to the Lectures

"But," you think, "she could not really do anything useful."

A Beautiful and Useful Life

Oh, yes, she can. First, she wrote the story of her life, and all about how she felt in the darkness and silence; and how her mind and heart bloomed like flowers in sunshine, when she began to learn. She has written essays on the delicate sense of touch. By hugging a tree she can feel it sing. She knows her friends by the vibration of their different footsteps on the floor. By laying her hand on a piano she can feel the rhythm and volume of music. She can read the speech of a few by touching the lips and throat. Anyone who knows the deaf and dumb signs can talk and read into her hand. She is quick at catching a joke and laughs merrily. She loves to feel a child laugh, and her little dog bark. She speaks of colors and sounds as though she heard them.

Feeling Trees Sing and Babies Laugh

How Helen "Hears" Color

She writes like a poet, and her mind is as pure as an angel's. No one has ever told her anything evil. Yet she knows there are sad things in the world that should not be. She learned that much blindness in babies is due to neglect. So she writes and talks about it. She gives the money she earns by writing to help others. And she helps them by showing how beautiful and brave a human soul can be, what difficulties it can overcome; how the most afflicted can be useful and cheerful.

Who that is making complaints about the little things of life can think of Helen Keller without feeling ashamed?

The Use of Pictures in Teaching

THE mind comes to know the world chiefly through the sense of sight. It is estimated that eighty per cent of our primary notions about the things of the world come through the eye. "The eye is the window of the soul."

Pictures the First Knowledge

Not only do we acquire so many ideas through seeing, but ideas thus gained seem much more real to us and they certainly are also more exact and vivid.

"Seeing is Believing"

One may describe to you in words some strange creature like a coffer fish. You get a vague notion of what it looks like, but you feel that you would like to see the animal itself or a picture of it. When you have seen it your impression becomes clear and definite. You are satisfied that you know how it looks.

Effect of Pictures on the Understanding

The sense of sight is so important a factor in gaining knowledge that "to see through it" has become a figurative expression to indicate that something is comprehended. The teacher says, "Do you see?" He knows the thing under consideration is not before the eye. He only means to ask whether you have a mental picture of the working of the object, or he wants to know whether the incidents of an event are passing through your mind in order as if they were actually taking place before you. Until you have a clear mental picture of a thing you have not really observed it.

Seeing and Understanding

Impressions gained through the eye are the most lasting.

"Sounds which address the ear
are lost and die
In one short hour; but that which
strikes the eye
Lives long upon the mind; the
faithful sight
Engraves the knowledge with a
beam of light."

The impressions and ideas received need to be held in memory. Otherwise the mind is empty except for what is immediately presented to it. Without memory you could not think at all, because you would not have at one time different ideas to bring into thought relations. If the memory is weak or faulty, thinking will be loose and uncertain. If you wish to remember, you must make sure you get very clear, definite notions in the first place. The best way to do this is to observe very carefully. It will not do just to glance at an object or scene or picture and immediately pass on to something else. You must hold the mind closely to the details until a deep, clear impression is made; then the impression will be readily recalled. Try this with

Importance of Memory

How the Egyptians Fattened Geese

Bas-relief in Egyptian Museum, Berlin.

any of the pictures you are examining and see if you do not find it so.

Need of Visual Aids to Instruction

There are so many interesting and important things in the world to be known that even the most favored persons cannot see them all directly. Only a few can travel extensively, and even these need some means of bringing objects, scenes and actions back to mind. There is a way by which the world, with its great variety of natural scenery, industries, people, art and the wonders of science, can be brought to us. This is through pictorial reproductions and graphic representations of these things. Man's very first way of making a record of ideas so others might get them was through picture writing. The early Egyptians carved many pictures on their temples and the American Indians wrote only in a sign language. We can tell positively some of the customs of the Egyptians and the implements they used many centuries ago, by studying the pictures found on the monuments that have been preserved of their early civilization.

Man and His Sign Language

Men have always been able to make drawings and paintings, but this was for a long time a slow process. The development of photography and the invention of various processes of printing pictures, have made it possible to produce them cheaply and to multiply copies of them, so that everyone can now have them in his own home to study and enjoy. We call such pictorial aids to knowledge "visual," because it is through the sense of sight that we make use of them.

Value of Pictures Compared with Words

Language is one means of expressing ideas. Pictures are another means. Each has its special advantages. We need them both, but pictures are the most direct aid to understanding, hence they are coming to be so largely used in books. Words, whether spoken, written or printed, are only symbols of ideas. They have no meaning until real mental pictures are associated with them. Pictures represent things much better than words alone and are a more accurate and vivid means of expressing ideas. It is for these reasons that pictures have come to be so largely used not only in schools, but in all kinds of publications and in commercial enterprises.

The First Illustrated Text-book

It would seem strange now not to

From the First Picture Book

The Clouds. VIII. Nubes.

A *Vapour*, 1. ascendeth from the *Water*.

From it a *Cloud*, 2. is made, and a *white Mist*, 3. near the Earth.

Rain, 4. and a small *Shower* distilleth out of a *Cloud*, drop by drop.

Which being frozen, is *Hail*, 5. half frozen is *Snow*, 6. being warm is *Mel-dew*.

In a rainy Cloud, set over against the Sun the *Rainbow*, 7. appeareth.

A *drop* falling into the water maketh a *Bubble*, 8. many *Bubbles* make froth, 9.

Frozen Water is called *Ice*, 10. *Dew* congealed,

Vapor, 1. ascendit ex *Aquâ*.

Inde *Nubes*, 2. fit, et *Nebula*, 3. prope terram.

Pluvia, 4. et *Imber*, stillat e *Nube*, guttatim.

Quæ gelata, *Grando*, 5. semigelata, *Nix*, 6. calefacta, *Rubigo* est.

In nube pluviosâ, oppositâ soli *Iris*, 7. apparet.

Gutta incidens in aquam, facit *Bullam*, 8. multæ *Bullæ* faciunt spumam, 9.

Aqua congelata *Glacies*, 10. *Ros* congelatus,

have any illustrations in our books, but it was not so very many years ago that the first text-book was printed that contained pictures.

There once lived a man who was a great teacher and thought much about the way to give boys an education (girls did not then attend school). His name was Comenius. He noticed that his pupils did not get the meaning of the words they memorized and that they were not much interested in their studies. It seemed to Comenius that his pupils should be learning about things themselves and that there was a better means than words for presenting objects to the mind. At last, in 1657, he published the first illustrated text-book, called the *Orbis Pictus,* that is, "The World Pictured." The book was a very marked change from those previously in use and it soon became very popular. One page just as it appears in the second edition, published in London in 1659, is reproduced on the opposite page.

The Father of Picture Books

Note that the picture is accompanied by a description in Latin and the vernacular, that is, the language of the common people. The first edition, published in Nuremberg, was printed in Latin and German. The second edition is in Latin and English. The page shown illustrates some of the different forms of water. Note how much information is given in a little space and how much the picture, crude as it is, helps to give meaning to the words used. Comenius tells how the vapor ascends from the water and from it a cloud is made, or sometimes a mist, which is similar to a cloud but hangs near the earth. So he goes on through the list of forms. He numbers the names of the different forms and puts the figures on the corresponding parts of the picture. Perhaps you know some Latin and can read the second column.

Comenius said that his object in using pictures in this book was to entice children to learn, to stir up the attention and to present things so they could be comprehended through the sense of sight rather than through words alone, which he found were memorized without understanding.

Learning to Interpret Pictures

But remember it is the mind and not the eye that really sees. The eye is merely an optical instrument that brings light from an object to the brain. The eye presents to the mind much that is very interesting, but the mind must give close attention to the various features of the object and must react upon them. The aim should be to form a correct mental picture corresponding to the thing or the picture presented to the eye. If you are satisfied with vague impressions, you can never be a good observer. It is necessary to hold the attention to the object for some time and to put forth some effort to note the several parts shown, their size, position, form, color and arrangement.

You cannot at first see a picture as a whole. You must begin with some part of it. When you understand this part, you may pass on to another and then to still another. Learn to observe a picture in an orderly way and to bring your observations together into some significant groups. In this way you can acquire the ability to think.

How to Observe Accurately

Some persons succeed better than others in this world because they have learned how to use their eyes.

The Daughter of Niobe

From the statue in the Vatican, Rome.

Not every one becomes educated by attending school. Some persons who have had few opportunities offered by the schools get the greatest enjoyment out of life and are very helpful to others because they early formed the habit of making intelligent observations and thinking about what they see.

Reading the Picture First

Pictures are attractive. How interesting they are! There is a temptation to turn over the pages to find others. But one should not be content merely to look at pictures one after another in a superficial manner. First you should examine them closely to note just what they show, and when you have interpreted them the best you can with the knowledge and training you have, then you should read the text for suggestions and explanations. You will, perhaps, be surprised when you have done this reading to find how much more there is in the picture than at first you thought.

Exercises in Observing Pictures

Test yourself by the accompanying pictures to learn how much ability you have to observe and interpret them. In each case examine the picture carefully before you read what is said about it. Find out what different things you see represented. Note the several parts and the form, position and size of each. Observe how the parts are related to each other. See if you can tell what useful purpose is served by the different things shown. Try to explain the meaning of everything you see. Then read the text immediately following the picture. When you have done this, reading very thoughtfully, examine the picture again. You should find it easier and more enjoyable to study in this way the later pictures than the first one, though some of them are really more difficult to explain.

A Typical Holland Farm Yard

Perhaps your attention is taken first of all by the people in the picture. Note that there are three women, two boys and a small child. Each woman has a scarf about the neck. In two cases the scarf is crossed over the breast. How many of the women wear a peculiar, tight-fitting white cap on the head? What odd clothes the boys wear! If you have noticed these and other peculiarities of the appearance of these persons, you have learned one important set of facts shown by the picture.

Things to See in This Picture

Now study the buildings. The barn has an unusual roof made of thatch. It is not a very large barn and the farmer who owns it provided another means of protecting part of his hay. A roof, also made of thatch, is supported by tall posts. This roof over the hay was raised as the stack became higher. Why do you think so? Are you quite sure you have noticed how many sides there are to the stack? How many surfaces has the roof? How many posts must there be? What makes you think there are more than four of each?

The house in which the family lives is apparently quite small and is made of brick. It is common for houses in the city to be made of brick or stone, but this is evidently a country home. One may conclude that bricks are common in Holland if even the farmhouses are made of them.

Examine the wagon. How many

A Farm Yard in Holland

wheels has it? Can you tell by how many horses it is drawn? Did you see the dog in the picture? Is the sun at the right or at the left of the farmyard? How clean and neat everything about the yard looks!

Clay and Sand Deposits, at Roseton, N. Y.

Next is another picture that is very instructive if you read it rightly. Look first to note the different parts of the picture. Remember that objects, form, structure and relative position are indicated in a picture by light and shade and by lines of different character and direction. Do you see a thin layer at the surface of the earth? That is soil formed by the action of the air, frost, rain and vegetable growth. Below the soil note a thicker layer. It is sand.

Mother Earth's Layer Cake

Still farther down is a great mass that seems to be of a different structure. It is made up of fine, smooth material arranged in thin sheets and it is separated at intervals by seams running horizontally. This mass is clay.

Now try to interpret the meaning of this picture. Many ages ago when this part of the earth was covered with water, the fine particles of clay settled in even layers on the floor of what was probably an arm of the sea. Then some great change occurred in the level of the ocean floor, and in surface conditions north of this area. Great glaciers were grinding up granite rocks and sandstone into fine grains, and as the ice which carried them southward melted, the sand was laid down in an even bed over the clay. Still later

Clay and Sand Deposits

the soil was formed by the agencies named above.

These beds, which are found all along the Hudson Valley, are now the basis of a great brick making industry. Bricks are made from clay and sand. Nature has here deposited these materials in just the right proportion. Compare the thickness of the clay and the sand layers.

You can learn further from the picture how the clay is taken out. See if you can tell why the clay is worked out by tiers as shown in the picture.

What a lot of information is thus to be gotten from a very simple picture that does not at first attract much attention! Those who have not learned how to observe would probably pass such a picture by with a mere glance of casual interest.

Pictures Challenge Thought

Pictures can be used effectively to challenge thought. Gaining information only is not enough for the student or the man of affairs. Teachers often complain that their pupils do not think. How are they to learn to think, when the school exercises consist very largely of giving out information through words? Very often these words produce no clear mental picture. If the facts are remembered at all, the pupils have in mind little more than the phraseology they have learned. The ability to reason is acquired, not so much by repeating reasons given by others, as by practice in reflecting on what is seen. Avoid, therefore, looking at

How Pictures Make You Think

A July Day in Australia

This is a view of Mount Kosciusko, "The Roof of Australia," in New South Wales, from a photograph taken in July.

pictures in an aimless way. Every good picture presents a problem in thinking. There is something to account for. Do not allow yourself to pass on until you have at least begun the solution of some problem.

A Day in July

Had you thought of Australia as having snow? Besides, this picture was made in July when we in America are sweltering with heat. How do you account for this scene? The mountain is only 7,500 feet high. This picture should lead you to turn to a map and to apply some facts you have already learned about climate. The mountain is in about the same latitude as Sydney.

The First United States Mint

A problem here is to infer where the building was photographed. The picture itself tells when the building was first used for a mint. Of course, the United States had only one mint at this time and it would naturally be at the seat of government. If you do not know where the seat of government was located in 1792, turn to your history. In this way you acquire information for a purpose and by your own effort.

The picture also helps give a true idea of the relative smallness of our country's finances at the time.

Pictures of Things that are Types

Some pictures represent types of objects or scenes. They stand for what is common and not unusual; things that are to be found in many different places, or they may be char-

Where Are We Now?

Suppose you were suddenly dropped down in front of this old building, could you tell where you were? Do you remember where the seat of government was in 1792? Of course there is where you would find the mint. Is there a mint in this same town today? Where are the other mints?

The Story of Two Valleys

A. The Young Valley

acteristic of a whole people or country. Many of the pictures in this book are of this sort.

It is well known that the erosion of water is constantly changing the surface of the earth. A small stream begins to wear its way into the earth. First it cuts deeper and deeper and forms a V-shaped valley like A. As it gets older, it carries away more and more soil at the sides. The valley becomes wider and takes the form of the letter U as in B, having a small fertile plain on either side of the stream. We call the former a young valley, the latter an old one.

It is very important that such pictures be recognized as representing a class rather than a particular place.

Objects of Interest for Their Own Sake Represented by Pictures

On the other hand, some pictures are to be studied for their own sake. The particular object is, itself, the thing that is of interest and importance.

This is true of such a feature of natural scenery as the Matterhorn, a famous mountain of Switzerland. Not to know about this remarkable

B. The Old Valley

The Matterhorn

peak is evidence of ignorance of the world's great natural scenery. To have seen, and especially to have climbed the Matterhorn is a matter of pride with tourists.

In the same way one wants to know for its own sake a beautiful piece of sculpture like the statue of the Daughter of Niobe now in the Vatican, Rome. It represents the skill and imagination of a great Greek sculptor. To know this statue is like being familiar with Tennyson's *The Brook* or with any other important work in literature.

No verbal description can give a correct idea of the Matterhorn or of this piece of sculpture. To be understood and appreciated they must be seen either in the original or in a good picture.

Pictures in Literature

The proper place of pictures in literature needs special consideration. They should never take the place of the words of the writer. Literature gives by itself a word picture and one must endeavor to get the thoughts and feelings of the author through the rich language used, which often is figurative.

Pictures are not needed to carry a story; sometimes they are helpful in description, as when the scene presents what is altogether unfamiliar, but even here the mental picture should be gotten so far as possible from the words of the writer; for

literature appeals to the imagination and the aim is not scientific accuracy.

Pictures are often useful in making one acquainted with the writer and his environment. The home and associations of an author influence his writings.

Every reader is somewhat familiar with the delightful writings on nature by John Burroughs. Did you ever stop to consider where and how he lives? Perhaps the picture of the place where he does most of his writing will help you to know the man better and love him more. You can easily imagine him day after day looking out upon the beautiful Hudson River, the Catskill Mountains forming a fitting background. His study is a small structure of one room, and from its windows he can look up and down the valley.

The Home of John Burroughs

The vineyard at the right is his and he also has many trees about the place. Back in the mountains he has cabins to which he often goes both in winter and summer. Is it any wonder he writes on nature when he is so surrounded by its beauties and wonders!

Perhaps, too, our pictures of the man and his home will make you want to read more of his accounts of wild woodland life.

Reproductions of Paintings

Rosa Bonheur was a wonderful painter of animal pictures. How could most persons ever really know them if it were not for good reproductions? Almost all art would be denied to most of the world except

John Burrough's Study, Near West Park, N. Y.

Deer in the Forest

Painted by Rosa Bonheur. Metropolitan Museum of Art, New York.

for these reproductions in books and elsewhere. As it is, you can readily learn how to study and enjoy them.

What do you see in the picture of the deer in the forest? Much more is expressed than the form of the animals, though this is remarkably well shown. Continue to look at the picture. Let the eye penetrate the woods. How still it seems! How does the artist create this impression of stillness? The very ground seems carpeted with soft vegetation that is noiseless when the deer move. Two of the deer are very quiet and undisturbed. But one animal stands on guard. Its position shows that it is listening. How quickly the deer would get away if the guard heard any sound of danger. Probably you will see still other things in the picture. It is certain that the more you study it in this way the better you will like it.

Studying the Forest Scene

Try for yourself to see what the artist intended to express by the picture on the next page. What class of people is represented? What is the relation of the several persons to one another? What is their occupation? Was a balloon a common sight for them? Try to describe their feelings. What do you think about the way the artist has drawn the figures and placed them in the group? Why did he make the distance appear so indistinct? How does each of the two clusters of tall trees help the picture?

Pictures of Architecture

It is quite impossible to form a

The Balloon

© *Painted by Julien Dupre. Metropolitan Museum of Art, New York*

correct notion of a Greek temple, a Gothic cathedral, or any other piece of architecture, without seeing it or one or more pictures of it. There are verbal descriptions of Solomon's Temple, but no one has yet been able to produce a satisfactory drawing to represent it, because there are no remains of it or pictures made while it was standing.

Home of Edward Everett Hale

How much the photographic reproduction of the temple at Paestum tells of the appearance of the temple itself! You can be sure just how the columns look. You feel certain about its pediment and entablature. The picture impresses upon the mind the fine proportions of the building constructed by the Greeks in Italy, 500 B. C., as no words could do.

If you really learn through observation and study one important type of architecture like the Doric of the Temple of Neptune at Paestum, it will be a constant source of enjoyment to find the type represented in modern buildings. Carefully compare the Sub-treasury Building in New York with the temple at Paestum. How few important differences can be found!

All over the United States there are custom houses, banks and other public buildings and even private houses that make use of features of Greek architecture. Often it is the Ionic type as in the Hale House. Compare the capitals of the columns in the three pictures. When you go upon the street of your city or village, see how many Greek elements you can find in the buildings you pass.

Greek Building at Home

In the same way you can come to know Romanesque, Gothic and other kinds of architecture.

Selection and Use of Pictures for History Study

In the case of pictures to illustrate history it is especially important to know when, how and by whom they were made. A drawing or painting

The Temple of Neptune

The Subtreasury Building in New York

made contemporary with an event or scene has a different value than one made long after. A portrait painted from life by a good portrait painter is worth much more than one made by some unknown illustrator. A direct photographic reproduction of an object of historic interest is more convincing than a drawing. In short, one looks for evidence that the picture really furnishes some direct, authentic connection with the past.

Note that each of the following pictures represents a different type.

The Norse, or Northmen, are known as sea rovers. Long before the time of Columbus they had ventured far out on the ocean and it is generally believed they reached America about the year 1000.

This boat helps us to understand that they might have done so. It was made of heavy oak and was 78 feet long and 16 feet wide. Note the excellent lines of the boat, indicating the knowledge and skill of the Northmen in boat building. The nearer end of the boat is the stern. The picture shows the steering board, or rudder, which was regularly placed on the right side, giving the name starboard to this side of a ship. The two upper planks are missing, the third has holes through which the oars, 16 on the side, were placed.

There are many other interesting features of this boat. It was found buried under a mound of earth in Southern Norway. It was uncovered and moved to Christiania in 1880.

The flutes, bark horn, rattles and drum help one to think of the Indian as something besides a warrior and a hunter. But you will notice these instruments are quite different in their construction from those of the white man. They seem like very

A Norse Ship

This ship was built by the Norsemen about the year 1000.

Indian musical instruments, from the collection of Iroquois relics, in the New York Education Department at Albany.

rude instruments. They show, however, that the Indian was a social being. Music was much used in his dances and religious ceremonies. But with the Indians, as with all partly civilized people, time or rhythm was far more important than tone or harmony.

The scale is given because size is often an important element in the mental picture.

At the middle of the Seventeenth Century the lower end of Manhattan Island, now such an important part of New York City, looked very much as shown by the painting by E. L. Henry. There was much need for this fort, for the enemies of Holland were very jealous of her. Note that the church and other buildings of a public character were inside the fort. The houses with their tile roofs and strange gables look quite different from those of old Boston. The Dutch brought their own type of architecture with them from Holland. How the wind mill, too, reminds one of Holland! At the left is a wall of heavy posts, a stockade. This was to protect the young city on the north, especially against the hostile Indians. Wall Street, a synonym for the greatest money market of America, now runs along the line of this early "wall." The picture also shows Indian traders with their canoes. New York began as a trading post and has ever since been of commercial importance.

How New York Once Looked

This picture is quite different from a view of Boston. It was painted by a person who had never seen New Amsterdam, hence, it is

The Beginning of New York City

This is lower New York City as it looked when it was "New Amsterdam." The picture is from a painting by E. L. Henry and is used by courtesy of The Title Guarantee & Trust Company of New York.

somewhat imaginary. But the painter is known for his ability to produce historical pictures that are expressive and true in essential respects.

Study the next picture as a work of art and a historical illustration. Note and describe accurately each article of dress. Can you tell the special office of some of the men in the colony? Associate this picture with a view of Boston as showing devotion to the church. Do not fail to learn the time represented. The scene is not true for the whole colonial period, but represents the year during which King Philip and his Indian bands were terrorizing the country districts.

Summary for Parents and Teachers

Pictures are useful for entertainment and for serious instruction. The latter use is the more important one and it involves training.

The basis of visual instruction is genuine observation with discussion.

The following are some of the advantages that will come from the use of pictures in instruction: They awaken interest. They may be used as a direct incentive to reading and other forms of effort. They furnish a means of forming clear, vivid, and lasting mental impressions. Properly used, they are a direct and most effective means of training the judgment and the reasoning power. They help to give content to words. They aid the memory. They are the only means by which some objects, such as great works of art, for instance, can be faithfully presented to the minds of most persons.

Correct, vivid mental impression is essential, but accurate, pleasing expression is no less important. The latter is a true test of the former.

Pictures are aids of the best sort in the teaching of oral English. It is comparatively easy through them to have pupils use words with precision and to express with exactness what they have observed. If observations are made in an orderly way, sentence structure and paragraphing will present few difficulties.

Seeing pictures with the physical eye alone is insufficient. It is the mind that visualizes. A person must learn how to read, or interpret, pictures.

Visual instruction is always asking the questions: Where? What form? How large? What relative position? What color? What purpose? Let pupils observe or infer the answers. So far as possible, avoid telling them.

The use of pictures in instruction should be regarded not as an extra labor, but as a more effective means to an end.

Have a definite purpose in the study of every picture. Generally, a teacher should not say to a pupil, "Tell all you can about this picture."

A few suitable pictures carefully studied are much better than many merely looked at without plan or purpose.

The pictures on the wall, as well as those in books, at home and in the school have a molding influence on children both by the information they convey and by the feelings they arouse.

Not all pictures have educational value. They need to be carefully selected and rightly used.

Puritans Going to Church

Painted by George H. Broughton. *New York Public Library.*

Which Is the Best Ear?

Before reading the explanation see which ear you would pick out as the best. But you must tell why. Don't just guess.

The first ear is too big for its length. The third is too slender and there is too much space between the rows. The middle ear is the best proportioned one.

What King Corn Does for Us
and
What Some Boys Did for Him

This is Jerry Moore of Florence County, South Carolina, and the 228 bushels of corn that he raised on one acre.

CORN is an American plant. It is the "maize ear" of the Indians. When white people came to America to live they did not know how to use it. The Indians taught them to make hominy, and to parch and pound the grains. Then the white people built mills and ground the corn into meal to make mush and bread. They used the grain to feed their horses, cows, pigs and chickens. Now we grow more than twenty-five hundred million bushels of corn every year. That is four-fifths of all that is grown in the world. And most of the rest of it is raised in Mexico and South American countries. So, you see, it is the great American crop. The eastern half of our United States is a big corn patch. From May to November, no one can take a railway journey from New York to central Kansas, or from Iowa to Georgia or Texas without riding through hundreds of miles of green or yellow corn fields.

The World's Biggest Corn Crib

The newspapers do not say as much about the corn crop, directly, as they do about wheat. That is because the wheat is all sent to market to be sold, but much of the corn is fed to animals on farms. But if the corn crop is small, the papers say: "Beef and pork will

You Always Can If You Try

Earl Hopping, an Arkansas boy, belonged to a corn club. He couldn't get the use of a horse to plow his land so he asked his best goat to help him, and of course the goat did. Together they raised so much corn (an average of 80 bushels to the acre), that if every farmer in America did as well, the United States alone would grow as much corn as is now grown in the world, and leave a billion bushels over!

be higher priced." Milk, butter cheese, poultry and eggs are likely to be higher, too. Your mama and papa know how the prices of all those things have been going up—up—up, and never coming down.

How the Boys Helped Out Uncle Sam

That has been worrying "Uncle Sam"—the government in Washington City. In the department that helps farmers it was known for years that if the corn crop could be doubled there would be more food at less cost, and the farmers would make more money. The farmers were told how they could grow fifty bushels of corn on an acre, instead of twenty-five, with no more labor or expense, but few of them listened. Why?

Their minds were stiff. As men grow older their muscles are less limber, and their brains do not readily take in new ideas. With boys it is just the other way. They run at the word "Go!" And they are eager to try new things. So Uncle Sam said:

"Let's get the boys interested. We'll have corn clubs, and see which boys, following our advice, can grow the most and best corn on an acre of land."

Fifty thousand boys, from twelve to sixteen years old, entered the race.

50,000 Boys on the First Corn Roll

It began in September and lasted a whole year. When the corn was ripe in their father's field a printed letter, or bulletin, was sent to the boys from Washington, saying:

"Gather seed corn before a hard frost." They were told to gather long, fat ears from tall strong stalks, and store them away from frost and mice.

In February another bulletin told the boys how to test the seed. From

Work of Illinois Boys

This corn exhibit at the great World's Fair in St. Louis showed what Illinois boys could do. In many cases you see the boys sent their photographs to be exhibited with the corn.

ears at least ten inches long, with deep kernels set close in even rows, they must shell away the small grains at butts and tips. At home, and in district schools seeds were sprouted on wet sand and studied. Even city children can watch corn begin to grow.

Next, five grains from each seed ear were planted in numbered squares in a sand box. If a seed ear was perfect five sturdy plants sprouted in its box. It used to be that when farmers wanted three stalks in a hill, they planted five seeds:

"One for the blackbird, one for the crow,
Three for the farmer to get out and hoe."

But it wasn't the fault of the birds. Good seeds all come up. If half the seeds are bad there will be only a half crop. Good seeds are one-half the battle in raising corn. The other half is good land and careful tilling.

Corn Teachers From Washington

In April men teachers were sent out from Washington to help the boys select and prepare their acres. The rich creek bottoms, river valleys, and the level prairie lands of the South and Middle West are best for corn; but the same treatment will not do for all. Uncle Sam's men knew all about plowing, draining, fertilizing, planting and cultivating corn.

"When the corn is in, begin at once to cultivate with hoe-plows to keep the weeds down, the soil loose and a dust blanket on top, so no water can be drawn up by the sun, ex-

A Southern Boys' Corn Club

Here is the Boys' Corn Club of Hancock, Georgia, and their prize ears all neatly laid out in the baskets. You remember it was a Southern boy who beat the world's record in raising corn.

cept through the plants. Plow every seven or ten days, and especially after a rain hard enough to cake and crack the earth.

"Plowing and hand hoeing killed most of the root worms and grubs. Plants with 'smut,' a sooty, black fungus disease, were cut out, suckers pulled and small, weak tassels cut off."

Each boy kept accounts, for farming is hard work and serious business. A good farmer must know just which crops make money. A boy paid his father $5 rent for his acre and $2 a load for manure. His own time was valued at ten cents an hour, and a horse's time at five cents. The boys grew from four to seven times as many bushels on their acres as their fathers grew in neighboring fields.

Boys Beat Their Fathers Raising Corn

That was the beginning. The next year the boys were set to studying their land, and told that corn growing and animal fattening go together. After corn has been raised on a piece of land for four or five years it should be planted in clover and grass and used for pasture. In four or five years more the land is rich enough for corn again. Then the corn should not be sold but fed on the farm. A pound of corn is worth less than a cent, but a pound of fat animal, milk, butter, cheese or eggs is worth several cents.

Putting Legs on the Corn Crop

"When the Frost Is on the Pumpkin"

Harvesting corn is very different from getting in wheat. In September the good farmer selects his seed ears in the field. The corn is cut with sword-like knives or machines, and stacked, or "shocked" in tent shape to shed rain. When pumpkins

A University Lecture on Corn

This class of boys won prizes in a Wisconsin seed corn contest. The professor, as you see, is talking about oil in corn. Most of the oil in corn is contained in the embryo—the spot in the center of the grain; so a large embryo means a large percentage of oil. The professor is pointing to a grain of this kind. The proteins that you read about in our article on the choice of foods are largely stored in the horn-like part of the grain at the top. Corn with a great deal of oil in it commands the best price from the glucose manufacturers who make corn oil as well as glucose, while corn with a small amount of oil and a great deal of protein is in special demand for feeding hogs for bacon.

have been planted after the last plowing, the big, golden fruit lies among the stubble. As Riley says:

"When the frost is on the pumpkin,
And the fodder's in the shock,"

there are gay "husking bees" in the hazy days of Indian summer. Men tear down the shocks and strip off the ears. Even boys and girls work like beavers to fill the wagons that horses pull away to the corn cribs. At night there is a supper, with popcorn, cider, apples, pumpkin pie, and merry games.

Every part of the corn plant is used on the farm. The corn leaves, husks and stalks are cut for "fodder" and fed to animals in place of hay. The stubble is plowed under to enrich the land. Cattle and hogs are fattened for the market. The farm horses, milking cows and chickens have their rations of corn every day in the year. If there is any to spare, the farmer shells it and sends it to market.

Corn's Contribution to the Farm

Many Things Made of Corn

That—a part of it—goes to mills to be made into meal, hominy, corn flour and corn flakes for people to eat. But ever so many other useful things are made of corn—starch, alcohol, corn oil, oil cake and corn syrup. For these things there are a hundred uses.

When Lincoln was a boy and meal was wanted, he rode to mill with a bag of shelled corn. The whole

grain was ground up into coarse, rich meal that made good bread just by adding salt and water. But that meal had to have the papery skin or "bran" sifted out, and it did not keep well. The gummy gluten in it and the oily germ, or baby plant, made it spoil like strong butter.

In grinding corn today the bran is blown out and the germ and gluten are sifted out. The germs are dried and pressed for oil. This is as good for cooking as cotton seed and peanut oil, and it takes the place of linseed oil in mixing paints. What is left, after pressing, is mixed with the gluten and bran to make oil meal or cakes for feeding dairy cows. The rest of the grain, which is starch, is cracked into hominy or ground into meal. Corn oil and oil cake are made in starch factories, too.

In Our Great Modern Corn Mills

Any child can make a little starch at home. Peel a potato, chop it fine and soak it in a pan of cold water. The potato floats, but starch washes out and falls to the bottom. If the water is poured away carefully the starch soon dries to a soft powder. In Japan starch is made from rice; in Europe from potatoes; in America from corn. There are eight grades of it, from the fine white corn starch used in puddings, cakes and toilet powders, to laundry lumps, and the coarse kinds for stiffening paper and cloth in factories. A great deal of starch is now made into corn syrup.

Corn Syrup for Your Hot Cakes

Sweet, golden syrup out of tasteless white starch! That sounds funny, doesn't it? But your stomach is a regular little syrup factory. It takes all the white bread, potatoes, rice and breakfast foods you eat and mixes them with the water you drink and a little acid into a sugary pulp. Factory men learned how to do this mixing outside the stomach. So corn

Father Goes to School Too!

You see, progressive farmers as well as wide-awake boys are making a science of corn raising. This picture shows a class of farmers studying their business during a winter course for farmers at the University of Wisconsin. They are judging corn.

syrup is pre-di-gest-ed starch. The starch is melted in water and acid, bleached and purified with soda, then boiled thick and clear, as are cane and beet juices in making sugar.

A great deal of corn is soaked and fermented into alcohol. Whiskey and other harmful liquors are made of alcohol, but useful things are made of it, too. It "cuts" or dissolves the stiffest gums, and takes up flavors and perfumes. So it is the base of perfumeries, fruit extracts and many medicines. It is used to thin fine enamel paints and varnishes and metal lacquers; for making celluloid, photograph papers and films and dye stuffs, and for mixing smokeless powder. As a fuel for certain lamps, and motor engines it takes the place of gasoline. If corn was worth only twenty-five cents a bushel it would pay farmers to have little stills and make their own fuel to run alcohol engines to pump water, run the corn cutter, churn and washing machine. One bushel of corn makes more than two gallons of alcohol.

Wide Use of Corn Alcohol in Industries

Uncle Sam's Big Corn Patch

"We grow more than 2,500,000,000 bushels of corn every year. That is four-fifths of all that is grown in the world. The eastern half of our United States is a big corn patch."

Farm Boys and Corn Crops of the Future

For the corn that is shipped to the Old World, ground into meal and table foods and turned into starch and alcohol, it takes only one bushel in every ten that is now grown. So, if twice as much corn should be raised that would mean that twice as many farm animals could be fed. And that would mean more and cheaper animal food, richer farm lands and more money for the farmers. Uncle Sam says:

"When the boys of today grow up they are going to stay on the farms and double the corn crop."

The prize winners are using their money to go to a-gri-cul-tur-al colleges. Those who can't go to col-

Two Fine Farm Crops

Boys and corn are two of the finest crops raised on American farms.

lege have learned that the government can help them. They have learned to read farmers' papers, to show what they have grown at fairs, to visit successful farms and government experiment stations, to know the value of good machines and animals, and how to keep their lands in good condition. They will not forget their corn club lessons.

Those Wide Awake Corn Club Boys

Look at our corn map. For many years the best corn states have been in the Middle West. But the dark area is stretching on all sides. Where the crops used to be thin, boys are now growing one hundred bushels on an acre. The Southern states had the poorest crops of all, because of bad farming. But the champion of 50,000 boys, Jerry Moore, lived in South Carolina. He grew two hundred and twenty-eight bushels on one acre. That waked the South up —boys and men, bankers and railroads and merchants. They said:

"In the South, where the growing season is long and rain plentiful, cattle can stay out on pastures all the year around. It should grow the biggest corn crops and supply the whole country with beef and pork and dairy products. You'll see! We'll change that corn map. Look out for your laurels, Middle West!"

Our country should be proud of these boys who showed the way to wealth. Not every boy could do

what Jerry did on his farm, nor could it always be done on a large scale. Jerry, among other things, brought rich mud from a creek bottom to build up his corn patch. But what Jerry did is a striking example of the fact that time and thought judiciously invested will greatly increase the corn crop anywhere and show large returns—not only in money but in development of skill, judgment, brains and character.

The Corn Harvest in Pioneer Days

From the Mural Painting by F. B. Millet in the Cleveland Trust Company Building

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The Corn Song

Heap high the farmer's wintry hoard!
Heap high the golden corn!
No richer gift has Autumn poured
From out her lavish horn!

Let other lands, exulting, glean
The apple from the pine,
The orange from its glossy green,
The cluster from the vine;

We better love the hardy gift
Our rugged vales bestow,
To cheer us when the storm shall drift
Our harvest-fields with snow.

Through vales of grass and meads of flowers
Our plows their furrows made,
While on the hills the sun and showers
Of changeful April played.

We dropped the seed o'er hill and plain
Beneath the sun of May,
And frightened from our sprouting grain
The robber crows away.

All through the long, bright days of June
Its leaves grew green and fair,
And waved in hot midsummer's noon
Its soft and yellow hair.

And now, with autumn's moonlit eves,
Its harvest time has come,
We pluck away the frosted leaves,
And bear the treasure home.

John G. Whittier

This Is How the Boys Did It

Arranging the Ears for Study

The good farmer selects his seed ears in the field. But these ears must be carefully tested before the seed is planted. The first step in testing seed corn is to arrange the ears side by side on a table where they can be studied and compared.

Picking Out the Weak and Poor

Next, the weaker and poorer ears are discarded. You see, they have already thrown out five. Among the things that indicate good yield are size, shape, solidity, weight of the ear, depth of kernel, size of germ, well-filled tip and butt. If an ear is not mature it will not ripen, and so, of course, cannot be used for seed. Lack of maturity is shown by too large an ear, too deep a kernel, chaffiness and light weight, looseness on cob, and dull, starchy appearance. Then you want to know if an ear will grow, so you ask—is the kernel clear, bright, smooth and horny, with a large germ, or heart? When the germ is dull and cheesy in appearance, or of a dark color, you throw that ear out. If the germ is white and brittle it is strong; but yet it must be tested to determine whether it will grow. Here is another point; an ear of corn may be excellent in every particular but not have a good "family history" back of it.

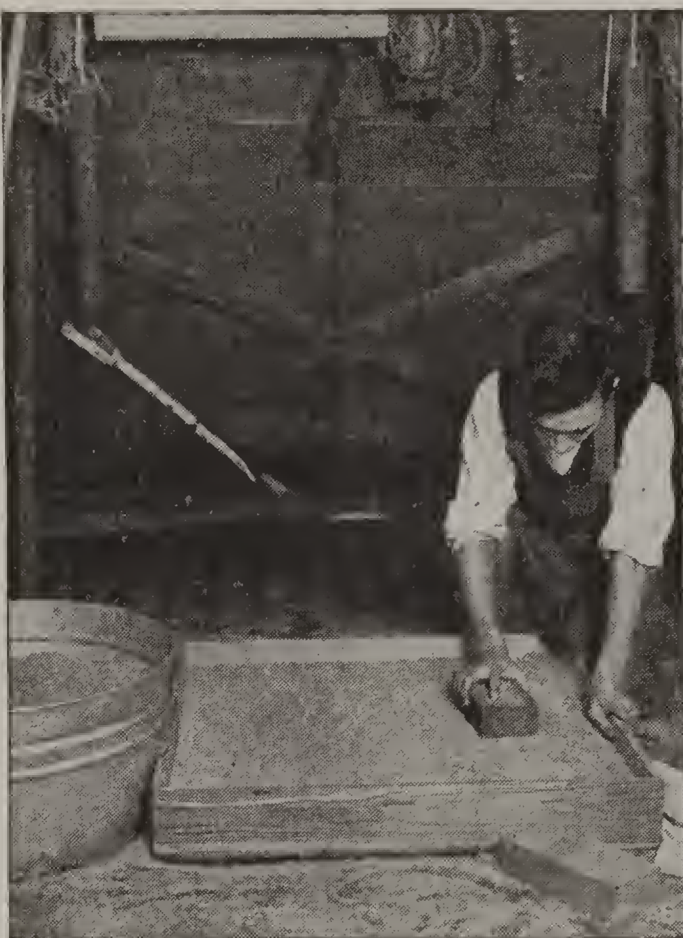
The Next Three Steps

Having selected good ears in this way you must now examine the kernels. Take two or three from each ear about one-third of the length from the butt; lay them germ side up at the tip end of the ear from which they were taken. If the kernels are small, wedge-shaped, narrow, too shallow, too deep; or show immaturity, starchiness, tendency to mold; or if the germs are small, shriveled up, blistered, weak or frozen, the ear should be discarded.

Next lay out in rows and separate into divisions of ten ears each the ears selected. Write numbers on the table opposite each ten ears, as shown.

This young man is showing you how they get rid of the excess water in the sawdust. You notice he is also using his feet, both to hold the bag while he twists it and to squeeze out water. Too much water in sawdust will make it cold and soggy, which will keep the seeds from germinating just as will ground that is too wet.

Preparing the Germination Box



In the next two pictures the germination box is being got ready. It is filled about half full of warm, well-soaked sawdust and packed down level and firm with a brick so as to leave the surface even and smooth.

A cloth is now put in the box. The boys are tacking it in carefully around the edges. Notice that there is a margin of 2½ inches around the edge of this cloth—it is called the "germination cloth"—and that there are little squares on it. These squares are 2½x2½ inches. The box is large enough to test 100 ears of corn. The box itself is 30x30 inches and 4 inches deep.

Kernels for the Germination Box

Remove six kernels from six different places in ear Number 1 and place them in square Number 1 of the germination box. Do the same with all the other ears until the box is filled. In removing kernels take two from near the butt on opposite sides of the ear, two from the middle and two from the tip, turning the ear enough so as not to take two kernels out of the same row. Now you see why the ears are numbered. You leave them just where they are until the seed test is over. The seeds in each of these little squares are numbered to correspond with the number of the ear in the row. If the test turns out well for the seeds of a given ear you take the rest of the good-looking seeds from that ear for seed. If they do not turn out well you use the ear for feed but not for seed.

Packing the Sawdust and Putting on the Cover Cloth

Now lay on the cover cloth, first dipping it in warm water and wringing it out. This cloth helps to keep the kernels in place.

Now cover the seeds and fill the box with warm sawdust, tramping it down, or packing it with a brick. It is better to use a brick because you can cover the seeds more uniformly. You know you want to make it a fair race and say "may the best seed win."

"Teaching the Corn Geography"

It is a curious thing about these seeds that they seem to have to be taught the "geography" of their box. By raising one edge of it, as shown—the edge toward which the crowns of the kernels are pointed—they seem to learn that that part of the box is "up," just as the top of a map is north. So, when growing, they send their stems toward the upper part of the box and their roots down.

It will take a grain of corn seven to eight days to germinate. Keep the box where it cannot freeze—in an ordinary living room or cellar.

The Reading of the Test

Removing the Cover Cloths

Next you take off first the top cloth, then the cover cloth, as the boy is doing in this picture.

Reading the Test

Now comes the most interesting part of all—the reading of your test. Notice that the father is looking at the corn in the box while the boy is picking out an ear whose seeds have turned out well.

Here is Where You "Tell the Fortune" of the Seed Corn

Now, here we are looking right down into the germination box. Before you read the answer, see which grains you would pick out as the poorest, which next poorest, and so on up to the best.

You notice one of them did not grow at all. I wonder if they have that foolish old superstition about the "unlucky" number in Corn Land. Of course, the ear from which Number 13 was taken, as well as ears Numbers 2, 11 and 24 should go to the feed bin at once. Ears 21 and 23 should be used only in case of shortage. Ears 1, 3, 4, 12, 14 and 22 are strong. Tests show that there is often fifteen to twenty bushels less yield from weak seeds than from strong.

What the Rag Babies Say

This picture illustrates what is called "The Rag Baby Test" for seed corn. It is quite similar to the test we have been explaining. The test grains are wrapped in moistened rags and there left to sprout. After the sprouting they are distributed in little squares corresponding to the numbered ears, as you see.

Does it Pay? This is the Answer

Does it pay to test seed corn? Here is the answer. It took just as many grains of seed to raise the corn in the box on the left as in the box on the right. You can hardly believe it, can you? But remember what Jerry Moore did—and the other corn club boys.

The first thing, as well as the most important thing, in raising corn is the careful selection of the seed. This may sound very simple. We are inclined to say: "Why, you just pick out good looking grains," but in order to do this, you see there are about 20 different things you have to look out for.

After the seed has been sorted, tested and shelled and the bad kernels removed, it should be sacked up, one-half bushel in each sack, and hung in a dry place where it will not freeze—say, in a basement with a furnace or up in the attic. In one sack put the best hundred ears. The careful farmer plants the best seed on one side of the field, and from this picks his seed corn for the next year's planting.

THE WORLD AT ITS WORK

THE SUGAR INDUSTRY

To Fill That Sweet Tooth

In the artist's heading of this story of sugar you see the little boy and girl pulling taffy. The ground between them is covered with sugar beets. You can easily find the cane field, the big sugar factory and nature's sugar factory, the maple grove and the sweet sap dripping into the buckets.

IT IS easier to empty a sugar bowl than it is to fill it.

Oh no, you think. Mama just goes to the sugar box. But if that is empty, Johnny or Mary Alice runs to the grocery. The storekeeper telephones a wholesale grocery to hurry up those barrels of sugar that were ordered. The wholesale dealer says the car loads of sugar *he* ordered haven't come from the refinery. The refinery is waiting for ship loads of "raw" sugar to come from—where do you suppose?

The Sugar Bowl and the Mouse's Lost Tail

It's like the mouse's tail that was bitten off by the cat. The cat was willing to give it back if the milkmaid would give her some milk. The maid went to the cow. The cow wanted hay, and the farmer wanted rain. A whole string of people and things were put to work, so the mouse could have her tail again.

In the Happy Land of Sugar Cane

The story of our empty sugar bowl leads us back to sunshine and clouds, men plowing, green things growing, and mills grinding and cooking. You didn't know sugar was cooked? Why, any pickaninny —that's a cunning colored child down South—could tell you that. Pickaninnies eat raw candy. They toddle out to the fields where their good-natured black papas are cutting sugar canes. Sugar canes look like big corn stalks. They are juicy as water melons and much sweeter.

Many colored children and a few white ones live on plantations in our country's big, black sugar bowl. They have the happiest times!

The World's Sugar Bowl

This map shows the cane and sugar producing regions of the world

© *Keystone View Co.*

The Pickaninnies' Candy Shop

Where the Sugar Cane Buries its Toes

It is 'way down in Louisiana, around the mouth of the Mississippi river. It is so warm there that the children go barefooted. They love to "sqush" the soft, cool black earth between their wiggly toes. Sugar cane likes that rich, drained swamp land, too. Men plow the land in furrows, as for corn. But they don't plant seed, although sugar cane has

seed. You know potatoes are not usually grown from seed. The potatoes have "eyes" from which new plants sprout. So sugar canes have "eyes" at the bamboo-like joints. Canes are laid in the furrows and covered. Roots grow from the joints, and tufts of grass-like leaves come up through the soil. A field of young sugar cane looks like a corn field. But the plants grow faster and higher. They grow like Jack's bean stalk—twelve or fifteen feet from April to October.

What a Sugar Plantation Looks Like

It does not pay to grow sugar on small farms. One big plantation follows another, covering miles of warm, moist country. It is a beautiful, flat, green country. But, like the town that could not be seen for the houses, you would have to get above the cane fields really to see them. From a flying machine you could see, below you, a billowy ocean of bright green canes, blowing in the wind which comes from the Gulf of Mexico. Here and there a white-pillared plantation house would show like a white-cap on tumbling waves. The villages of negro cabins might be fleets of bark canoes, with their roofs of cypress bark. The tall brick chimneys of the sugar mills are plumed like the smoke stacks of ocean steamers. Through the two hundred miles long, emerald sea, the broad, brown flood of

A Billowy Ocean of Green

The Southern Cousin of the Corn

See how thick and tall the sugar cane grows. A cane field is a perfect jungle of shiny, green leaves that whisper and moan in the wind. On hot, still summer days they sing you a lullaby with their drowsy murmur, but when a storm is coming, they make a loud "swish, swish!"

Harvesting Cane in Cuba

Cane-growers cut and load their crop on racks just as northern farmers do their hay. See the smoke stack and buildings of the cane mill in the background.

the Mississippi River heaves and bends, and divides into many outlets. The sugar land is thus cut up into big islands.

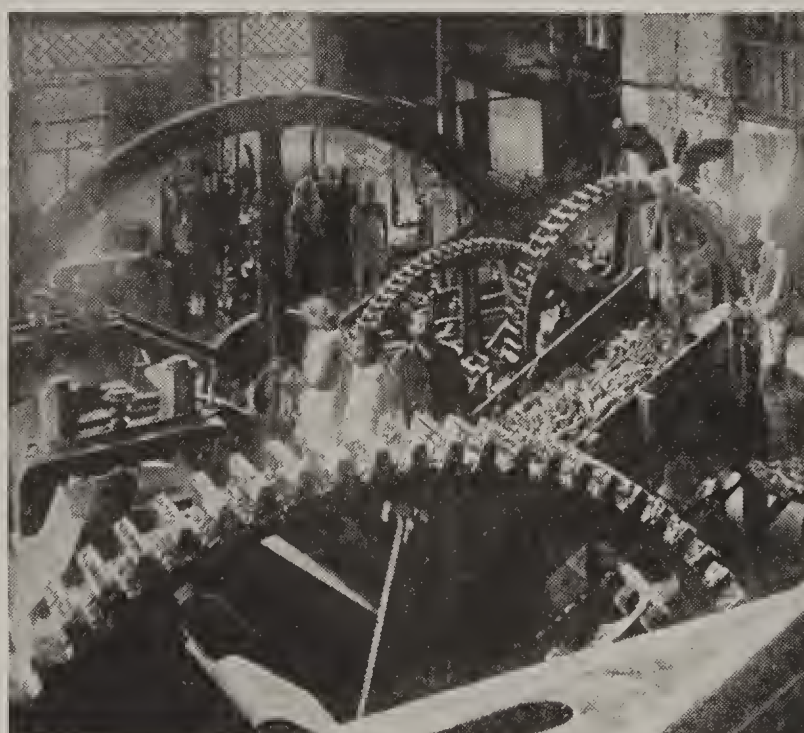
Each plantation has a river wharf. Boats tie up to these wharves and load with barrels of sugar. The river steamers carry the sugar to New Orleans. That city is the market for sugar and cotton.

Over the larger plantations you can ride on private railroads. It is cheaper to carry the cane to the mill in cars drawn by a little engine, than to keep enough horses and drivers to do the work. The track runs between high walls of slashing sabers and fluttering banners of green, topped with plumy tassels. Overhead flocks of little yellow sugar birds flit, and feed on the seedy tassels.

A Railroad of Its Own

A long line of negro men and women marches across a field. Each has a broad curved knife. One blow severs a thick cane. Slash—slash — slash! The canes are stripped and topped, and dropped in piles.

The Machine that "Chews" the Cane



Here the cane is crushed and then passes on to the rollers, which squeeze out the juice. See what a complicated system of wheels is needed to perform on a large scale one-half the operation which the small boy enjoys so much—"chewing cane."

These two little people have started a sugar mill of their own with mama's wringer. It is in just this way that cane is run through the big rollers in a real sugar mill.

A Ride to the Sugar Mill

Choo —choo —choo! The chuggy locomotive puffs busily along the field. The open, cart-like cars are filled with cane. You are riding to the mill. Such a clatter of machinery inside!

A broad, moving belt carries the cane to the top of the mill. You know wheat is carried to the top of the flour-mill. Many things made in factories are elevated by belts, or little buckets on link belts. This saves a lot of work.

Wringing Out the Sugar Juice

The canes in the mill fall step by step. Every time they drop something happens. At the bottom of a mill flour flows into bags, sugar into barrels. The sugar canes are caught between file-toothed wheels that crush them. Iron cylinder wringers squeeze the juice out. The canes are squeezed as flat as paste board and as dry as kindling.

Back Under the Boilers

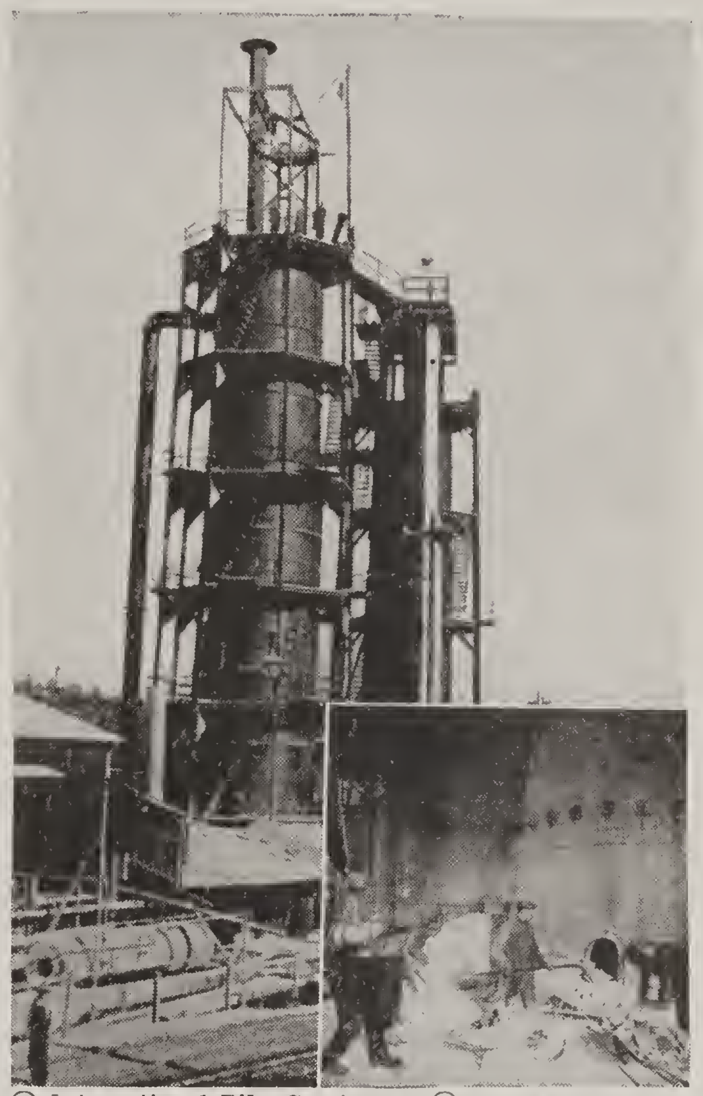
The canes are carried along and dropped into the furnace under the boilers.

How the Cane Helps the Cook

The boilers make steam to turn the mill wheels. The mill catches and squeezes more canes. The ashes from the furnace are spread on the fields to fertilize them. It works in an endless circle. Nothing is wasted.

Such Looking Sugar Water

The juice from the canes is caught in troughs. It has a dirty, greenish-gray color, and has a sickening sweet smell and taste. You never would believe it could be made into sparkling white sugar! It is "cleared" and "settled" with milk of lime, as mama settles coffee with the white of an egg. The lime also neutralizes, or kills, an acid that is in the juice. Sulphur gas forced through the juice whitens it. Milliners bleach yellowed straw hats with sulphur fumes. A dark, frothy scum rises to the top, just as it does when mama boils jelly. This is skimmed off. The clear, sweet sugar water



© International Film Service © Keystone View Co.
Burning limestone to be used in purifying beet juice.

© Brown Bros. N. Y.
Here is the dirty, "raw" sugar just as it comes from the plantation cane-mills. The men are pouring it through the openings into an elevator that will start it on its long journey through the refinery, from which it comes out shiny, white and clean.

flows away into big copper kettles that hold barrels.

Why the Sugar Kettles Wear Jackets

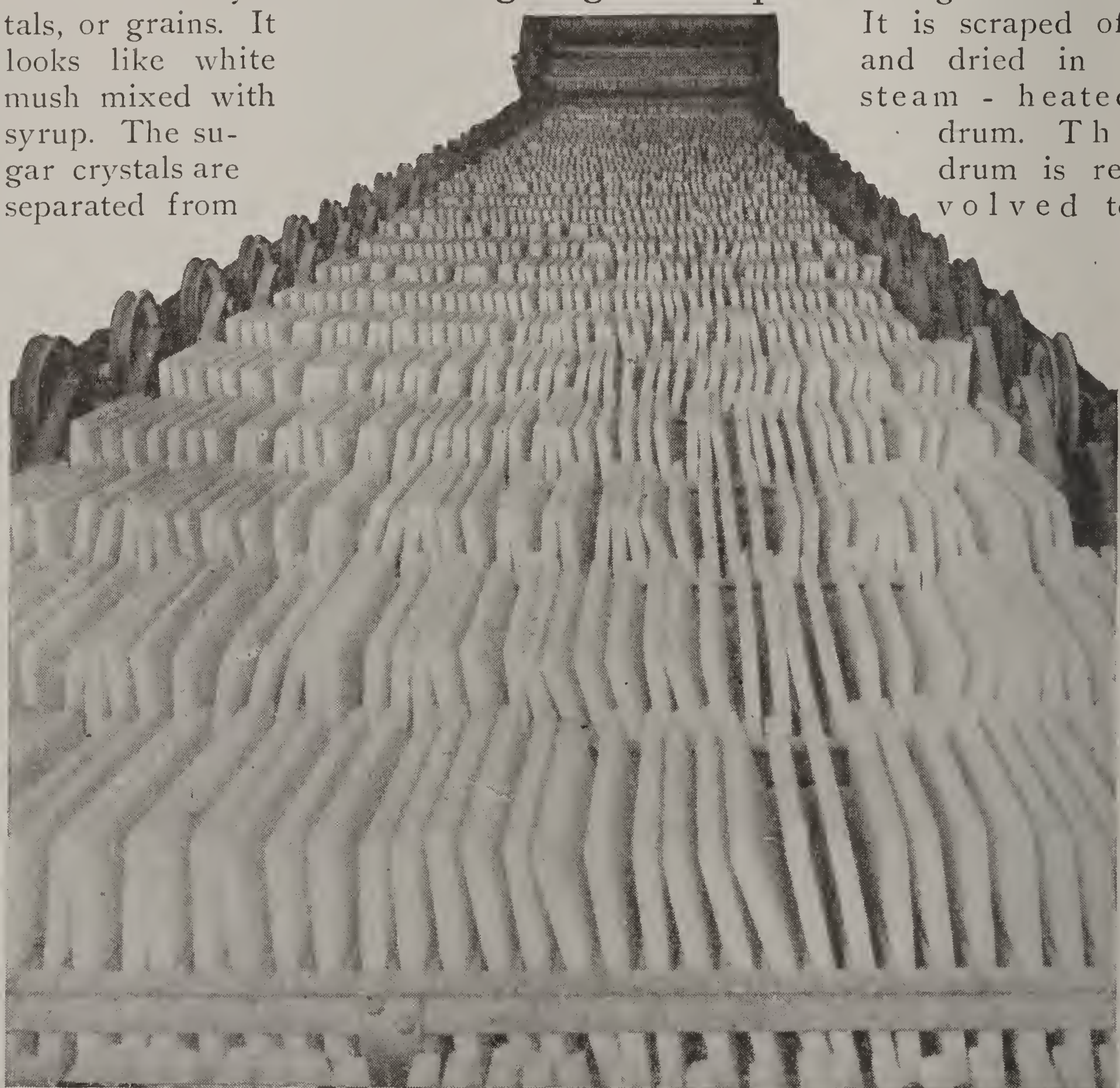
It wouldn't do to build a fire under those kettles. Sugar burns easily. The vats are heated to boiling in jackets of steam coils. The sugar loses its water in vapor, and boils to a clear, thick, golden syrup. For syrup making, the boiling is stopped at that stage. For sugar it is boiled until the syrup is thick with crystals, or grains. It looks like white mush mixed with syrup. The sugar crystals are separated from the liquid much as clothes are dryed in big steam laundries.

The Sugar and the Syrup

Whirl a soaked sponge by a string. The water flies off, in every direction. You could whirl the sponge dry. Wet clothes are put into a cylinder of holes and whirled, to force the water out. The sugar liquid is put into a big drum, with walls of the finest wire gauze. A whirling shaft forces the syrup through. Snow-white, but damp, the sugar clings to the gauze walls. It is scraped off and dried in a steam-heated drum. The drum is revolved to

Scraping the Big Sugar Bowl

What Big Sugar Lumps!



© Underwood & Underwood, N. Y.

These are plates of sugar, fourteen inches long, ten inches wide and an inch thick, which have just been taken from the molds shown on the opposite page. They will be kept moving on this conveyor through a "stove"-room for twenty hours until they are thoroughly dry. Then each plate will be cut into the "lumps" we use in our coffee.

The purified sugar-liquid or syrup is boiled until it has begun to crystallize. The man who has charge of this boiling knows just when the crystals are of the right size for the fine, sparkling loaf sugar you like to eat almost as well as candy. Here it is being poured into a big tank just after it has left the boiling pan.

That spout through which it pours is let down by the chain you see attached to it. It's like the big spout they let down from the railroad water tank when they fill the tank of the locomotive. The rubber tube at the side is for washing out the tank from time to time, just as you wash out the pan after you are through boiling the syrup in making taffy. On the left you see the paddle which keeps the sugar from solidifying in the tank.

© *Underwood & Underwood, N. Y.*

Those iron cylinders are called "wagons." They contain molds into which the hot half-crystallized sugar is poured. Here it stays for forty or fifty hours. When it is cold and hard big cranes lift the molds from the wagons by means of the iron rings which you see on the top of each mold.

© *Underwood & Underwood, N. Y.*

keep the sugar from lumping. As sparkling white, granulated sugar, fine and dry as sand, it flows through spouts into barrels.

Cut-loaf sugar isn't cut. The granulated sugar is pressed, while damp, into rows of oblong molds, on a cylinder machine. The flat, sugar dominoes are just the right size for using in coffee and tea. They are the purest cheap candy for children.

A great deal of "raw," or dark brown, dirty sugar is shipped to us from

Cuba, the Philippine Islands and other countries. So, in San Francisco, Philadelphia and other sea-port cities, there are sugar refineries. The raw sugar is dumped from bags into elevators and sent to the top of the refinery. It is mixed with water, melted, filtered through bone charcoal to take out the dirt, bleached and boiled and finished.

Sugar That Gets Its Face Washed

But perhaps it isn't cane sugar in your bowl. It may be beet sugar. There isn't nearly enough of the warm, moist land with rich soil, to grow all the sugar cane the world wants. In the Hawaiian Islands, where the weather and soil are just right, the fields are irrigated, that is, watered from mountain streams. The work then is done by Japanese and Chinese coolies, who learned in their own countries, to irrigate rice fields. Nearly all the work in sugar cane fields is done by black, brown and yellow people, who are used to the climate. White men cannot work well in such warm, damp countries.

The Hawaiian Island Fields

© Keystone View Company
Testing the Processes in the Laboratory.

The Sugar Made from Beets

A hundred years ago men began to think about trying to make sugar from other plants that would grow in our cooler northern country. The bees told us long ago that there is honey in flowers. Sweet corn and peas and sweet potatoes have sugar in them. But the beet roots have more. And more of them can be grown on an acre of land. They grow in every kitchen garden in our northern states, and in Europe. More than half our sugar is now made from the beet root.

The seeds are planted in rows like potatoes. When full grown they are from fifteen to twenty inches long and six across. They weigh a pound to a pound and a half. Several tons can be grown on one acre. The flesh is not the blood red of our little turnip-shaped garden beet, but is a light red. They look more like pink parsnips than beets.

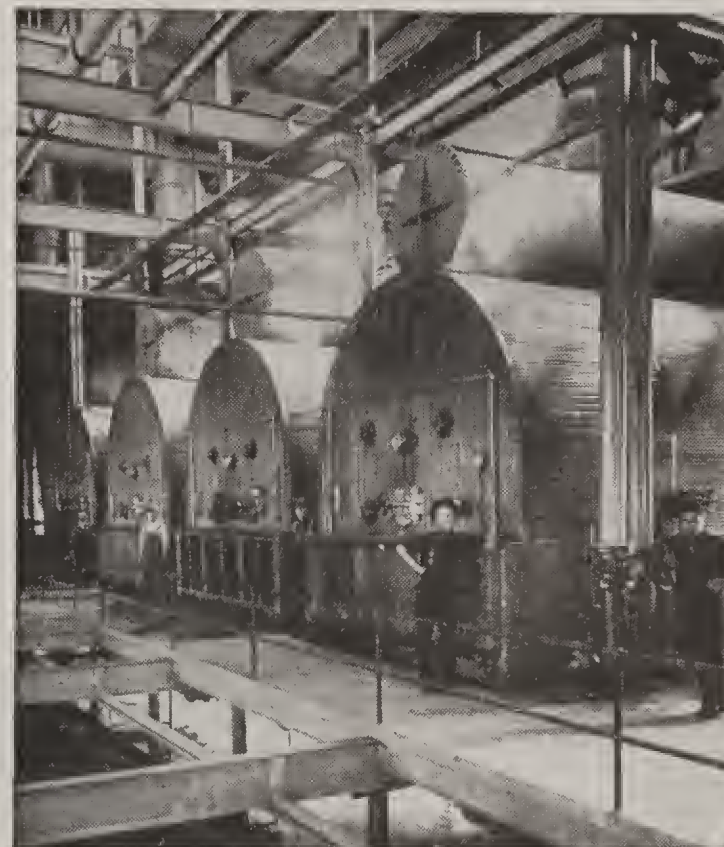
In the Sugar Beet Fields

In the Beet Sugar Refinery

When dug, in September, the roots are topped, and then scrubbed in washing machines. At the refinery the roots are cut into long pencil-like strips and covered with warm water. They move about from one vat to another. The sugar is not squeezed out, but soaked out, as a cook soaks the salt from codfish. The water turns the same muddy

This Sugar Water Is Soaked Out

© Underwood & Underwood



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Three Steps in the Making of Beet Sugar

The cylindrical vessels in the upper left hand corner are called diffusion batteries and are connected with each other in series. After being thoroughly washed and sliced by machinery the sugar beets are heated in one of these cylinders or cells. Then the sugary liquor from the next cell is allowed to run in. The cell thus filled is the head of the battery. The preceding cell, whose liquor has just been drained, is emptied of its spent slices and filled again with fresh ones, thus displacing cell number one as head of the battery. And so the process goes on through the whole battery of twelve or fourteen cells in turn until the juice is ready for the saturators, where it is purified and filtered.

To the right are the great boilers for concentrating and crystallizing the sugar after it has been purified. Below is a centrifugal machine which separates the crystallized sugar from the syrup. It contains a large porous cylinder which is revolved rapidly. Just as water flies off the grindstone when it is spun around very fast, so the liquid syrup flies outward through the holes in the cylinder leaving the heavier sugar behind.

black as that in which beets are boiled for dinner. But that water is as sweet as cane juice. It is purified with lime and carbonic acid and bleached until it is as clear as well water. Then it is boiled to a syrup and finished to granulated sugar. People used to think that beet sugar could not be as good as cane sugar. It is exactly like it. Both plants have in them the same kind of sugar. The sugar in raisins, dates, figs and other fruits is called grape sugar.

Playing at Pulling Candy

Did you ever watch the taffy man pulling his shiny, white candy over and over a hook? Let's pretend we're taffy men. Put your left foot forward and throw the candy forward and upward to the count, "One," being sure to make it catch on the hook. Then pull back hard with both hands on "Two." We must pull with all the muscle we have because the taffy is almost done and is very stiff.

At the Maple Sugar Pump

Maple sugar is made on farms in a few Northern states, in the early spring. The snow is still on the ground when the sap begins to climb, to feed the maple blossoms that come before the leaves. For two or three weeks there is a busy, exciting time in a maple grove. The farmers bore holes in the trees and plug them with wooden spouts. The sap runs into buckets hung on the spouts. The boys are kept busy emptying buckets into a cask mounted on a sled. A horse pulls the sled to the house, or to a sugar camp in the woods.

Boys in a Sugar Camp

Maple sugar water is so fine and clean that it is just boiled in big iron kettles, or long pans over an outdoor fire box. The syrup is skimmed and put into bottles or cans. For sugar it is boiled longer and poured into molds. It is our wild Indian sugar, with the spicy smell and taste of the forest in the spring. On the last night of sugar making, there is a frolic in the camp. The boys and girls make maple wax. The hot candy is poured by the spoonful, into snow banks, to harden.

Sugar that Tastes of the Woods

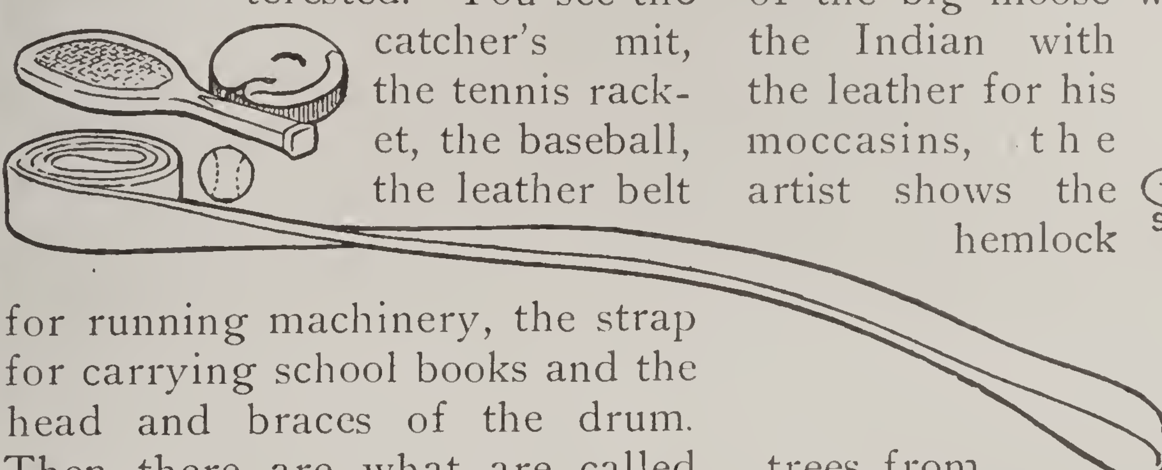
A Maple Sugar Camp

Oh dear! Don't you wish you were there?

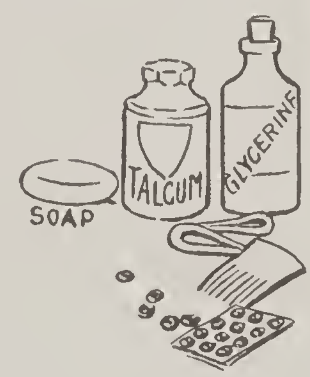
An Old Pair of Shoes and Its Queer Relations

You see What these Pictures Tell

THE pictures on this page show many things made of leather and growing out of the leather industry in which boys and girls are interested. You see the catcher's mit, the tennis racket, the baseball, the leather belt

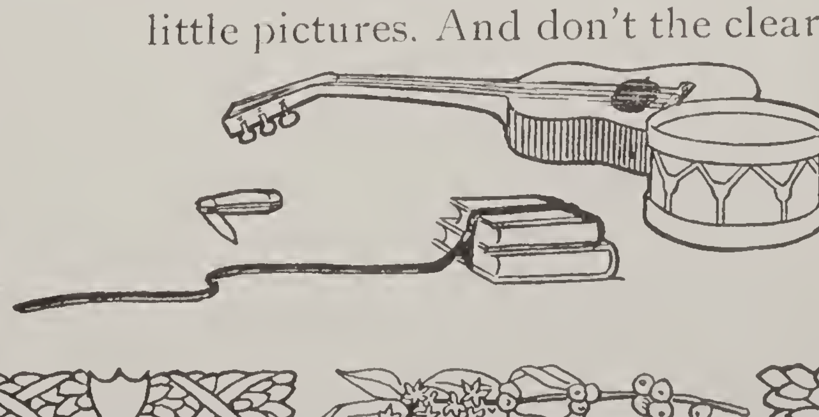


for running machinery, the strap for carrying school books and the head and braces of the drum. Then there are what are called "by-products" of the great packing industry which furnishes such a large proportion of the hides to the tanner. These by-products include soap, combs, buttons, glycerine, the horn handles of knives, the strings of musical instruments. Then, because the packer sells his soap and glycerine to the druggist, he also "jobs"—that is, buys of the manufacturer and resells as part of his own line—talcum powder and other things. Back of the big moose who furnished the Indian with the leather for his moccasins, the artist shows the hemlock



trees from which bark comes that is used for tanning. The horn handle on the knife blade is also one of the by-products of the packing industry and so is the glue used in binding the books.

So you see how much of our story of the great leather industry the artist has already told in these little pictures. And don't the clear,



simple outlines just make you want to draw them?

The very proudest thing a little boy or girl can have is a pair of new shoes—the shiny, squeaky kind that no one can possibly fail to notice and admire.

Your Good Little Two Shoes

"Just see how bright I am, and how much bigger than the last pair!" they seem to say.

Sometimes papa thinks children should be born with shoes on, as puppies and colts are. New shoes do grow old so fast! Every month or so he is surprised.

"What! Worn out already! Do you think shoes grow on bushes?"

"What *do* they grow on?" a little question mark on two feet is sure to ask, so papa might just as well put his paper down and begin to answer questions.

Questions for Papa

"Shoes grow on the back of animals with four legs—on hooky-horny cows, bawly calves, gallopy horses, butty goats and jumpy kangaroos. Leather is made of the skins of hairy animals."

Just think of having this leather menagerie in your house! That queer looking thing which is sticking above and below the picture—do you know what that is? That's one of those "smelly" hides that tells your nose when it's near a tannery.

And the alligator? Oh, he was bashful and tried to get out of the picture. But you see the artist caught him anyhow!

Why, you may have a leather zoo in your house! See how many kinds of animal skins you can find. It's as much fun as playing "Button, button, who's got the button?" There are kid or baby goat, dog-skin and buck-skin gloves. Very likely papa has a pig-skin bill-book,

The Zoo in Your House

How Mother Made My Moccasins

and a seal or walrus pocketbook and belt. Sister is proud of her pretty alligator shopping bag. You have books bound in half-calf, morocco and Russia leather. Spanish bull-hide is used for covering easy chairs and couches. And brother's college diploma is printed, not on paper, but on vellum, which is sheepskin. Maybe he has a scaly belt of snakeskin, a rhinoceros whip and porpoise leather shoe strings.

Many Kinds of Leather

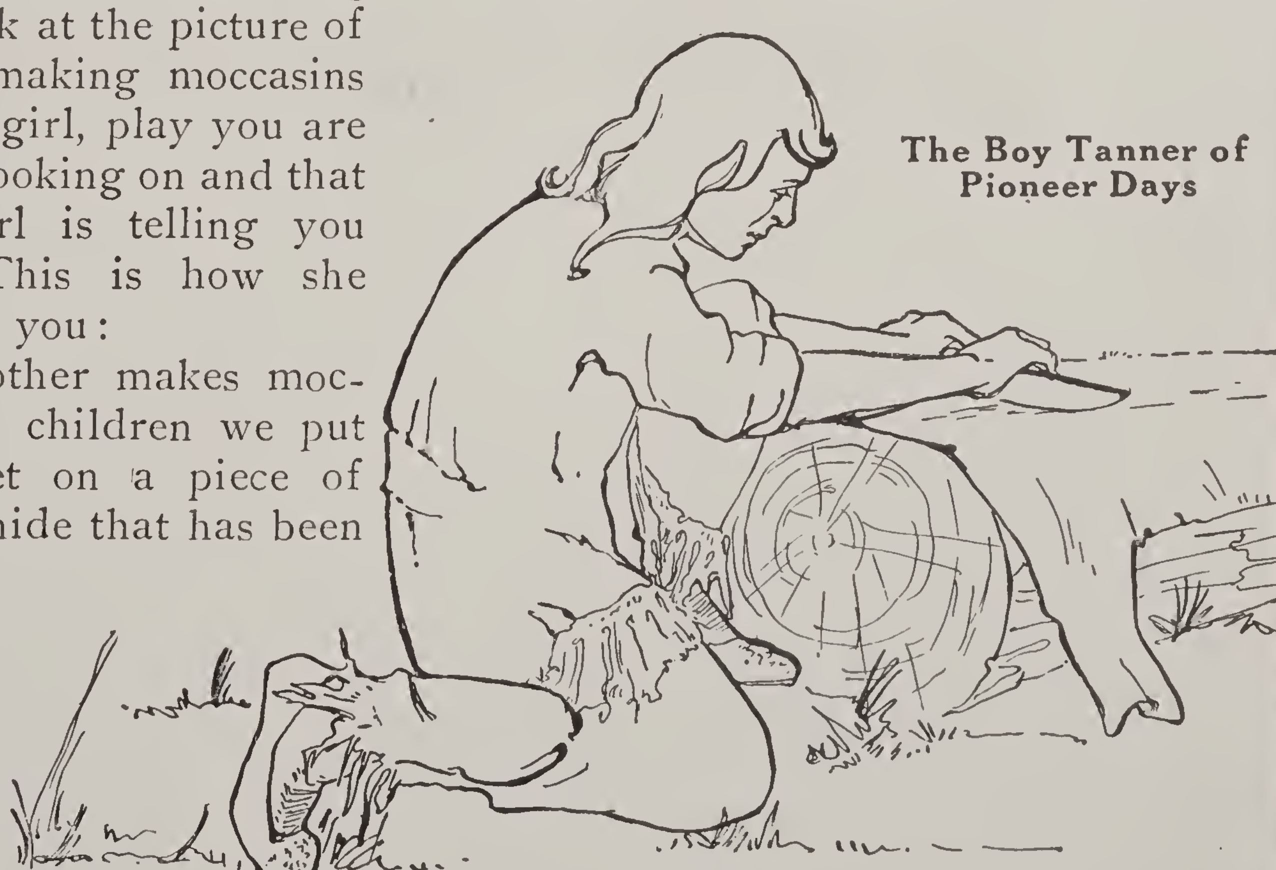
As you look at the picture of the mother making moccasins for the little girl, play you are really there looking on and that the little girl is telling you about it. This is how she might talk to you:

"When mother makes moccasins for us children we put our bare feet on a piece of tanned deer hide that has been wetted. She shapes and ties the skin around each foot. Then we hold our feet before the fireplace until the moccasins dry into shape. After that she gathers the top with deer sinews, rubs the skin nice and soft and we've got a brand new pair of shoes. When mother is shaping the leather around my foot it tickles; and then I laugh and she laughs!"

Tanning Among the Indians

So many things have to be done to animal skins to change them into leather. A skin is in two layers. The outer, hairy layer is a horny scarf skin. The Indians learned to soak their skins in lime-water and to scrape away the hairy layer with sharp-edged shells.

As the little pioneer girl helped her mama in making her new shoes—by holding as still as she could, even when it tickled—her big brother helped to make shoes and buckskin clothes by preparing the skin. Here we see him currying the hide—that is, scraping off the hair with a knife—after his mother had soaked the hide in water in which



The Boy Tanner of Pioneer Days

Leather on the Hoof

This map shows the regions of the world where sheep and cattle are raised. In western Europe and the eastern part of our own country we find a few sheep or cattle on each farm, but not many large herds, because the country is too thickly settled for pasture space. But in the heavily checked regions—in Australia, our own western plains, the southern tip of Africa and part of South America—there are great herds of both sheep and cattle. There are several reasons why they are there. Do you know what these reasons are?

she had put wood ashes. The water was in the long vat which father and the boys cut out of a log just as you dig out a canoe.

The inner skin is a soft, wet, rubbery mantle. It has blood and nerves and gelatin in it so it spoils as quickly as fresh meat. If not dried at once it must be salted to stop decay. When stretched and dried it is stiff and brittle. The Indians rubbed and pulled the skins, worked tallow into them to soften them and scraped them smooth. Their deerskin shirts and moccasins were as soft as broadcloth, and as pretty a yellow as chamois skins. But water soaked into them. You can melt chamois or buckskin to a gluey mass in boiling water.

You could not melt an old shoe. The leather in it has been tanned. Taste some tea that has stood on the leaves until cold. It is puckery. Oak galls, some acorns, sumach leaves, and oak, hemlock, willow and birch barks have that puckery taste,

Puckering the Skin's Mouths

These are oak apples—little bunches that grow on oak trees when the gall wasp lays her eggs in them. They are one source of the tannin used in tanning leather.

too. These plants have tannin in them. The tannin puckers the gelatin-like fibres of animal skins, and hardens them.

When There Was a Tannery in Every Town

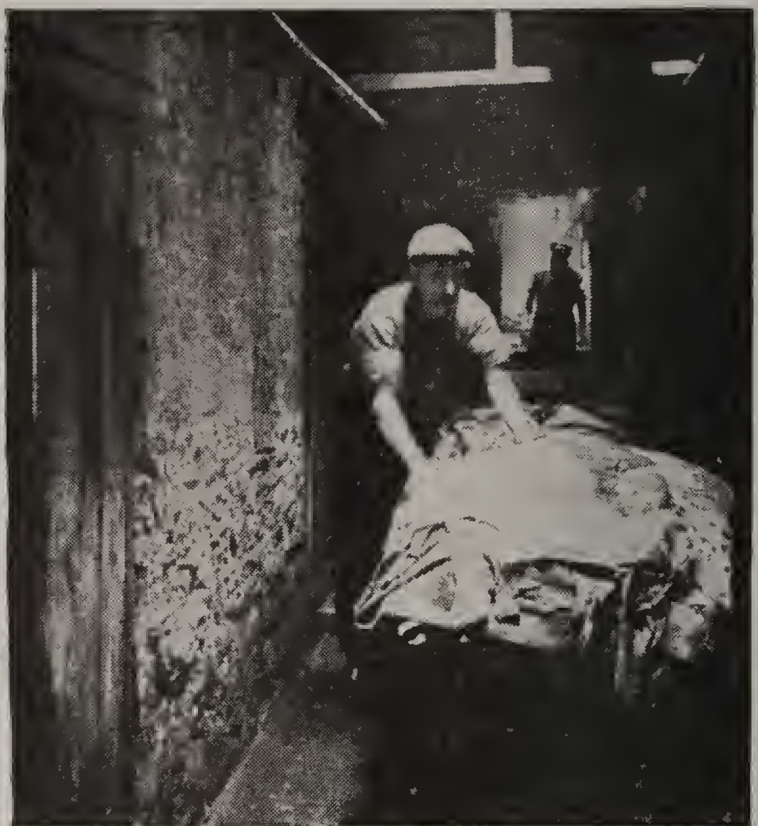
When our country was new every little town had a tan yard and the American pioneers tanned their own leather. After taking the hair from skins with lime water and dull-edged draw knives, the tanner put the skins into a big vat. Between them he put powdered oak or hemlock bark. Then he filled the vat with water. The skins soaked for months.

Leather is made in the same way today, but much more quickly. The

Soles Enough for Many "Hikes"

Here are endless piles of roughly shaped soles ready to be trimmed and sewed on to hundreds of pairs of shoes.

How Bossy's Skin is Changed to Leather



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Making the Hair "Fall Out"

On the left you see the stiff, hairy hides as they come to the tannery from the slaughter house. At the right they are being run on wheelbarrows into the "sweating" vaults, where the hair is loosened from them.

tanneries are in big brick buildings, near cities where there are packing houses, or near the seaports in New England. What kind of hides come from the stock yards? And where do we get kid and morocco, goat skins, seal, walrus and alligator—the fine "fancy" leathers?

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This picture shows the machine which begins the removal of the hair. It has a series of revolving knives which clip most of the hair off. At the right you see the final stage in removing the hair from the hides. It is called "beaming." As you see, the scraping is done with a sharp knife on a sloping board, called a "beam."

Tanning and Oiling the Hides

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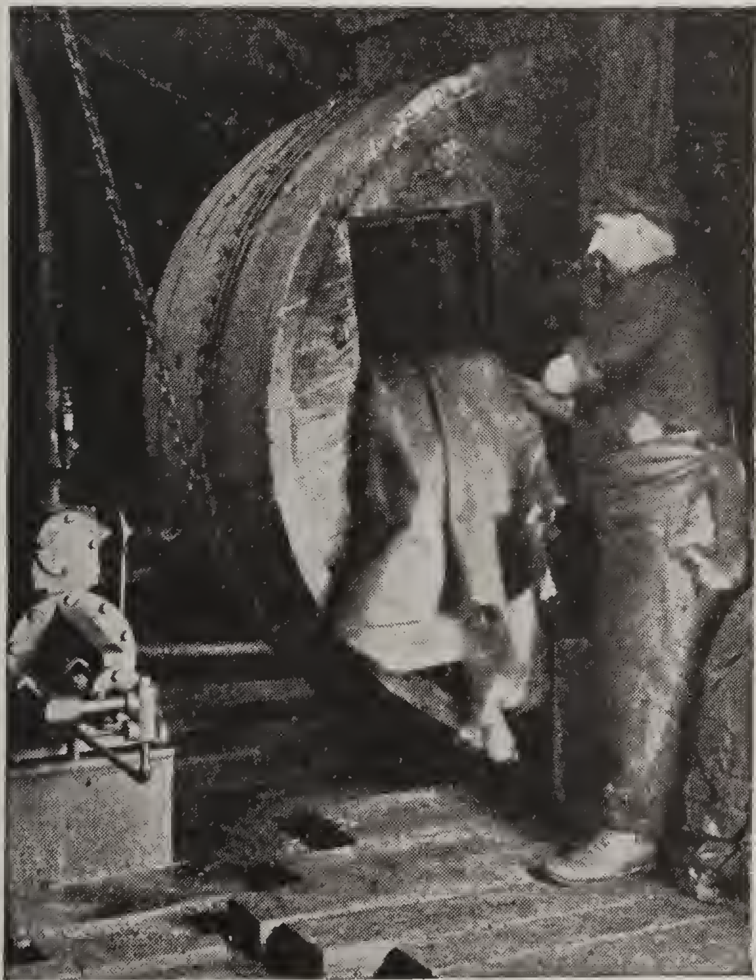
After the hair is removed, the hides are put in great tanning vats and thoroughly soaked with tannin. At the left, a workman is taking a hide out of a vat in the floor. Then the hides are oiled with a thick, gummy oil which you see in the barrel in the foreground of the next picture.



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The workman in this picture is putting the same hides into an oiling drum, containing hot fat. In the old-fashioned method of tanning, the hides were laid away in grease for a month. This is one of the devices which shortens the process. Next you see the oiled hides hung on racks to dry.

Putting on the Finishing Touches

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Next the hide is ironed smooth by machinery just as a stiffly starched white apron is ironed. The iron, you see, is a roller operated by machinery.

© *Keystone View Co.*

In this picture the man is blacking the leather. It is finished now, ready to be made into harness, shoes, traveling bags or saddles—depending on what kind of leather it is and how it has been prepared.

A Trip Through a Shoe Factory

Cutting "Leather Cookies"

The picture shows a boy with his razor-edged die that is like a cooky cutter. He is cutting up the small pieces of leather that would otherwise be wasted. In the shoe factory the boys who are just learning the trade do this. The pieces are used for backstays, tongues, and other small parts of the shoe.

Hides come to tanneries wet-salted, dry-salted and sun-dried. They smell very bad. They are hurried into a brine bath, then into a lime water bath. Knives on a whirling cylinder scrape away the hair. The skins are then put into strong tan water. The tannin is forced in by pressure, so the skins are tanned in a few weeks or days.

Your Nose Will Know a Tannery

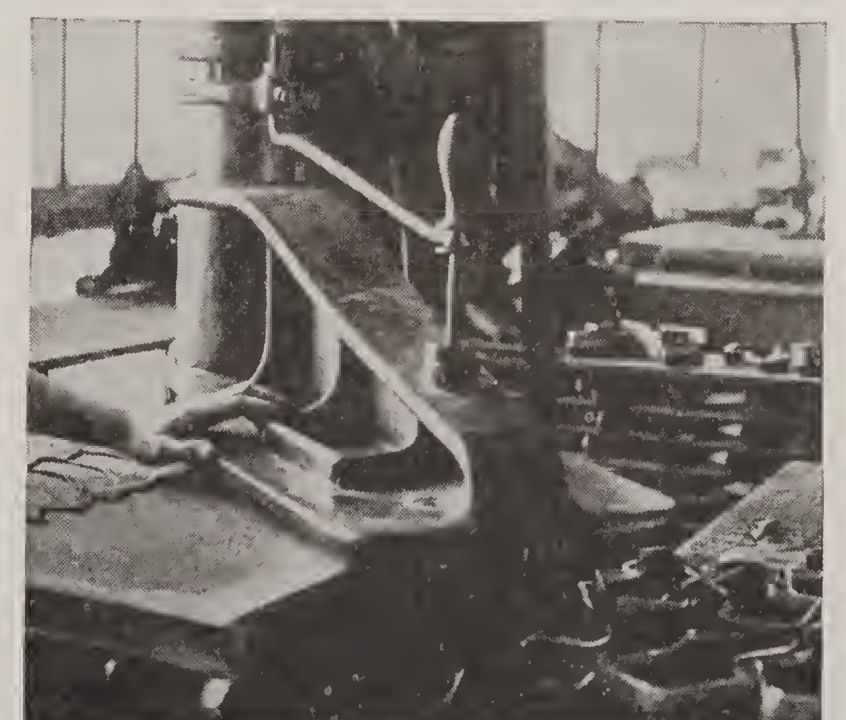
The tanned skins are dried, stretched, rubbed, oiled, pressed and hammered solid. The surface is sandpapered smooth, and then dyed, oiled and polished. Sometimes skins are split. Leather is made thick or thin, soft as satin and as thick and stiff as boards for shoe soles. Goat and seal are given a pebbled surface. Walrus is ribbed. An alligator hide is left the natural blocked markings of the skin. A bright or velvet finish is given to kid. Calf skin is usually finished smooth and dull, a "gun-metal" polish; but for making patent leather, calf skin is varnished, rubbed down and baked, just like a japanned tea tray. Most shoe leathers are dyed black or brown. But there are white buckskin shoes. And kid is finished snow white, or is tinted in the delicate colors of silk for party slippers.

How Different Hides are Treated

Where Your Shoes Are Made

From forty thousand tanneries in our country all kinds of leather go to market to New York, Boston,

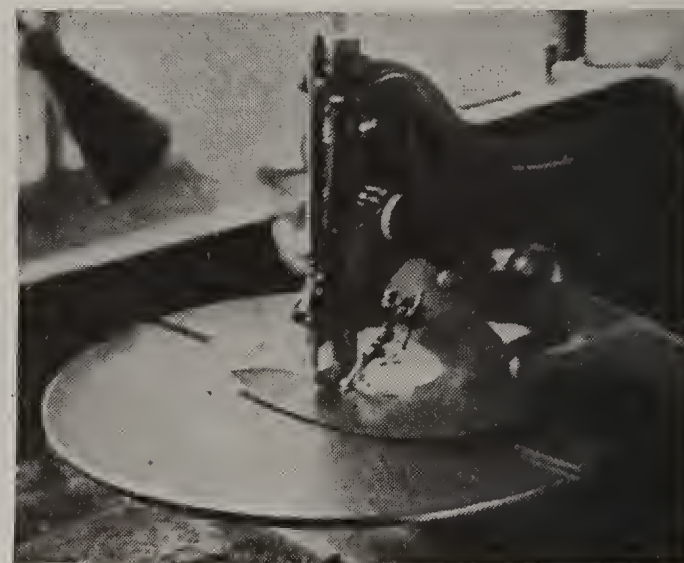
A Mechanical "Cooky Cutter"



This picture shows a machine that also does this work. Notice the cutters of different patterns at the right of the picture. The man doing the cutting chooses the pattern that will fit into his piece of leather with the least waste. It requires a skilled workman to do this.

A Trip Through a Shoe Factory

This is the crimping machine. The big white plate comes down upon the piece of leather which the man is holding in his right hand, and forces it into a slot only slightly larger than the plate. This "crimps" or shapes the leather.



This little machine looks something like mother's sewing machine. It punches the little holes that make a pretty pattern on the tips of your "Sunday" shoes.

This illustration shows a machine sewing backstays on shoes. It works very rapidly and the thread is not broken after each seam, but is carried over to the next shoe.

The leather in your shoes has to be thinned at the seams so they will not be so bulky and clumsy. Just beyond the cog wheel is an emery disc that revolves rapidly over the leather where the seam is to be and files it thinner.

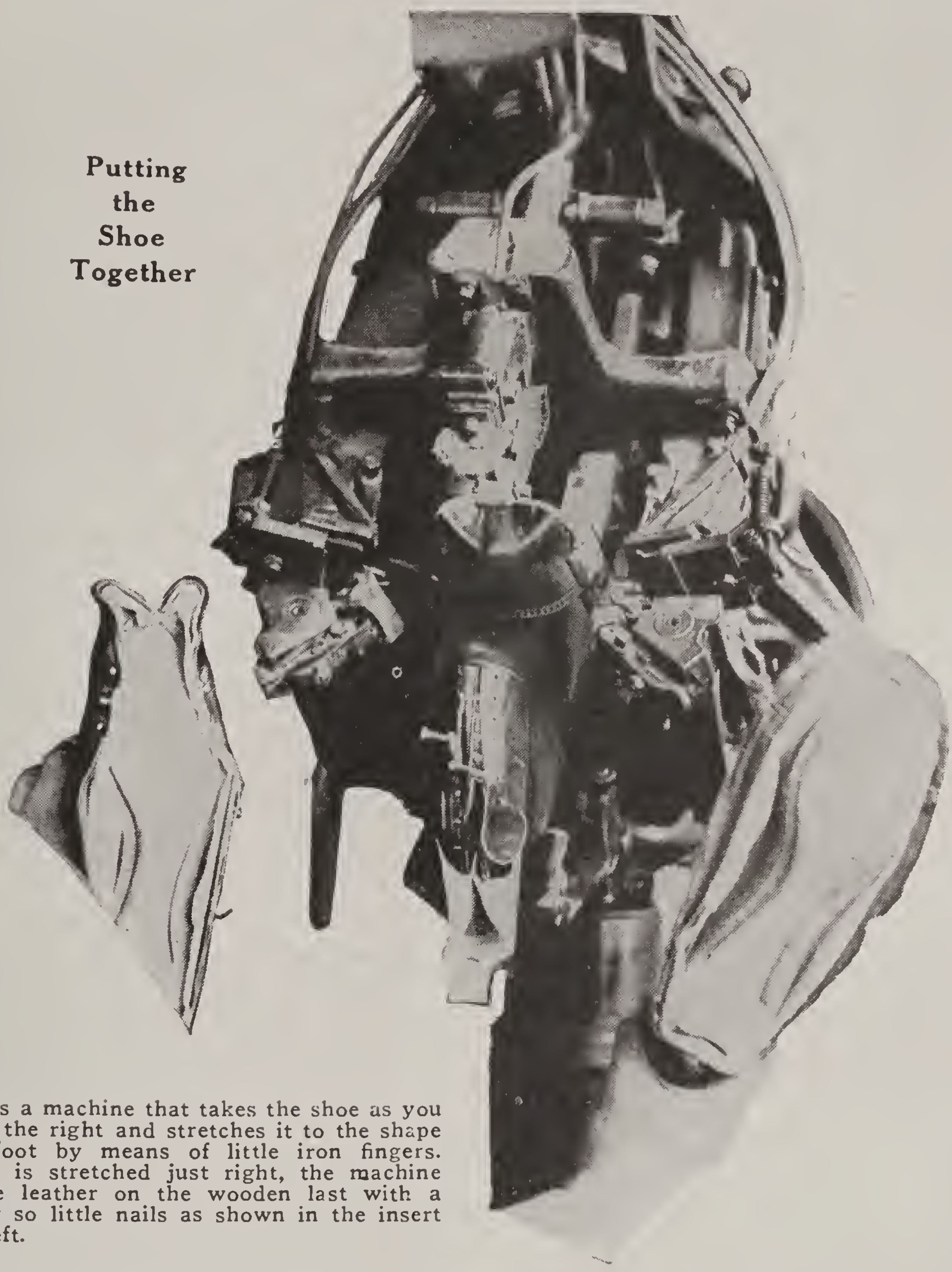
Here you see another sewing machine which is stitching the top of the shoe to the vamp. This machine sews up several such seams every minute. The workman operating it must be highly skilled.

Where Great Factories Are

Philadelphia and Chicago. The biggest shoe factories are in New England but there are many large factories in other parts of the country. Thousands of men and women work in these factories, but not one of them could make a shoe. Each one does

A Trip Through a Shoe Factory

Putting the Shoe Together



Here is a machine that takes the shoe as you see it at the right and stretches it to the shape of the foot by means of little iron fingers. When it is stretched just right, the machine nails the leather on the wooden last with a dozen or so little nails as shown in the insert at the left.

just one of more than a hundred things.

A little over fifty years ago one man did everything. An old time shoemaker was a clever workman, but it took him a day and a half to make a pair of shoes, with a boy to wait on him. He went from farm to farm with a box of tools. He stood children on sheets of paper and drew patterns of their feet. Notice how the pioneer mother is doing it in the picture. He gave them black, tarny shoemaker's wax to chew. In children's shoes he put copper tip toes so they could scuff all they liked. Red morocco tops were stitched in very nice Sunday boots.

How the Old Shoemaker Worked

When Lincoln was president so many men had to go to be soldiers in the Civil War, that there were not enough left to do the work. Something had to be done about that. All sorts of machines began

A Trip Through a Shoe Factory

This machine shapes the toe down smoothly to the last. A wire is strung around the toe to hold it in place, and the leather is nailed down around the heel as in the insert at the top.

The first picture shows the edges trimmed off. In the second, a strip called the "welt," to which the sole is fastened, is partly sewed on.

Here you see the shoe with the welt all sewed on and a gummy mass of cork composition rubbed over the bottom of the inner sole to make it waterproof. A piece at the middle, called the "shank," has been tacked in place.

to be made—machines to cut wheat, to sew clothing and to make shoes.

When the Work Was First Divided

One man at a machine, with a waterfall or a steam engine to turn the wheels, could do the work of ten men. Time was lost if he moved about from one machine to another to do different things. So each worker sat at one machine and did the same thing to many pairs of shoes, every day.

In a shoe factory today some strong men do nothing but unload bales and boxes of leather and other materials from freight cars. Others are in the stock rooms filling orders

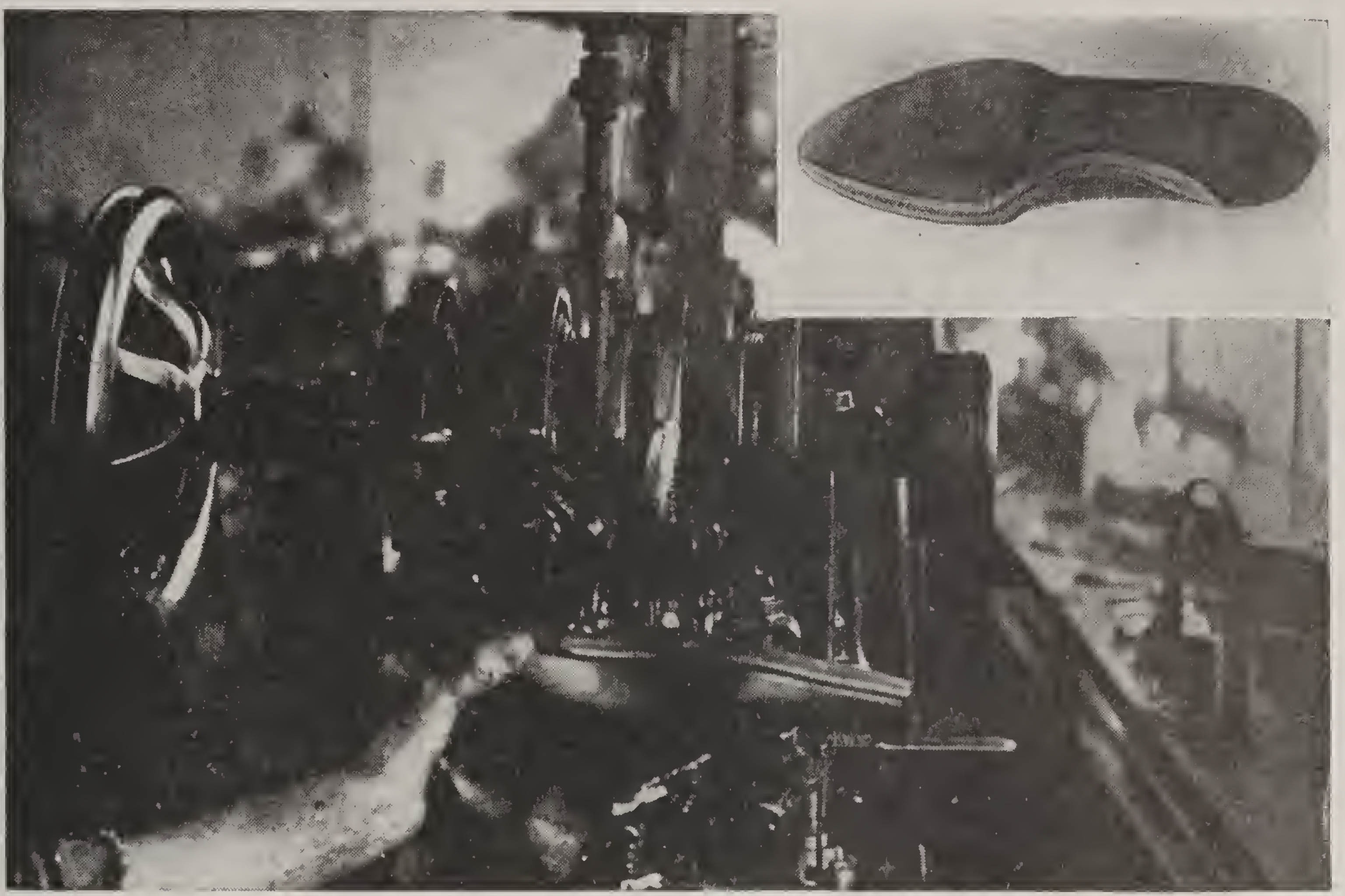
What a Busy Place!

from the foremen of departments. Messenger boys run back and forth. Trucks are loaded and wheeled into elevators. Supplies are lifted and trundled from floor to floor of big brick factories.

Story the Old Shoe Tells

Have you an old shoe that you can take to pieces? You will need a stout knife, a tack puller and a hammer. Pry the heel layers apart.

A Trip Through a Shoe Factory



This picture shows the shoe with the outer sole sewed on. The insert shows the shoe with the surplus leather half trimmed off. After it is trimmed it goes to the machine below, which is the noisiest and one of the most powerful in the factory. It stitches on the sole and must be heavy and strong for that work. Three or four of these machines running at once will shake a large building.

Anatomy of a Shoe

Find the welt strip on the upper edge of the sole, the steel shank that braces the instep, and the stiffening pieces in heel and toe. How many parts there are, and how neatly everything is fitted together! Exact cutting of every part of a shoe is very important.

The cutting rooms in a shoe factory have many windows. They are full of big tables, with flying wheels and belts over them. Each table has a different material on it. The cutting is done with dies. Dies are like cooky or biscuit cutters, except that they are of heavy steel with razor edges. Leather is slipped along a table, under a die. Down it comes like a steam hammer and cuts through sole leather.

Stamp! Stamp! Stamp! A whole hide is quickly cut into soles, heel pieces and welt strips. On other tables the shoe uppers are cut.

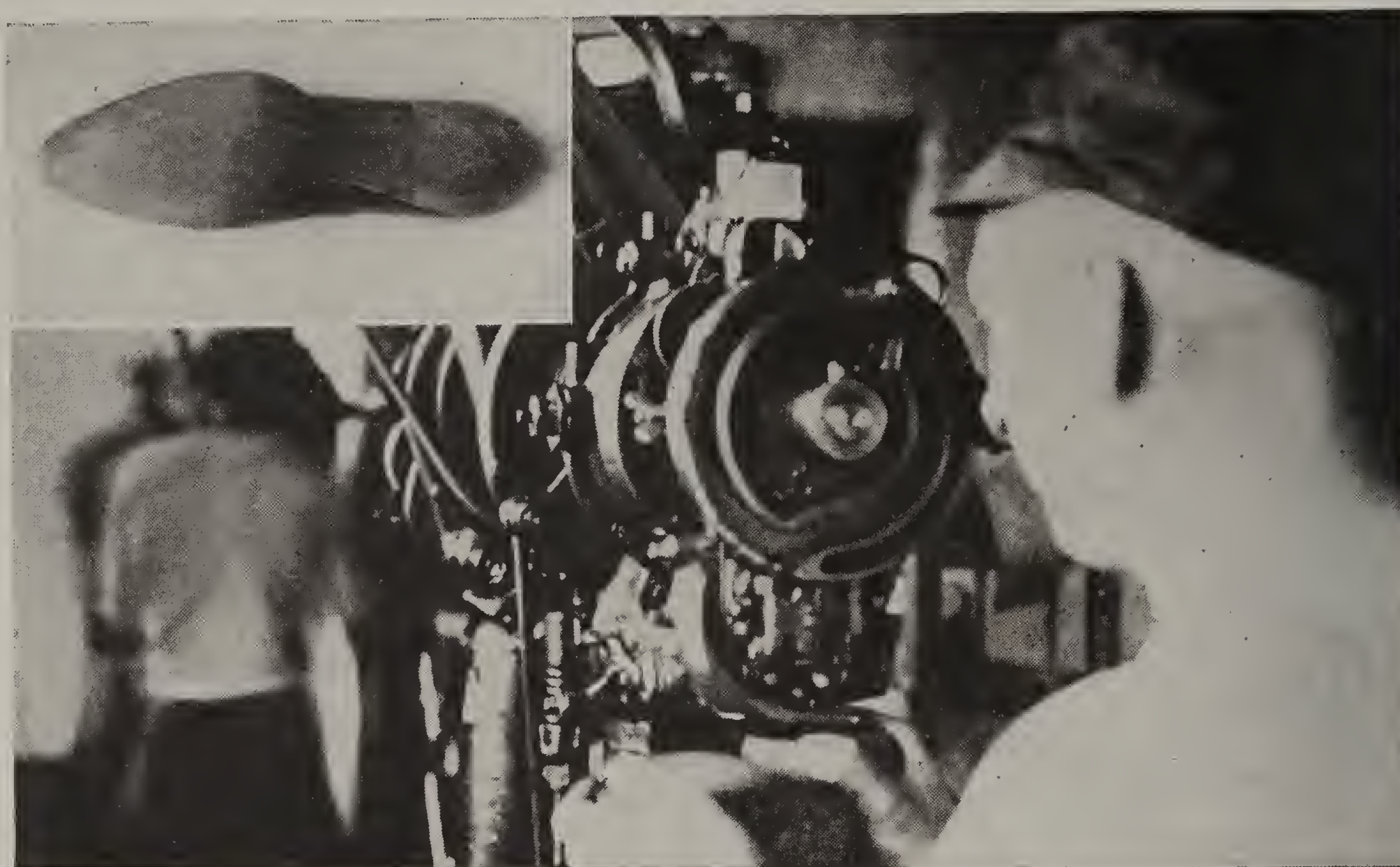
On the Cutting Tables

Each upper of a laced shoe is in three pieces. A buttoned shoe is in four. The vamp is the piece over the toe to the instep. Two side pieces cover the instep and ankle. A button shoe has a flap. Some shoes have a separate heel vamp. The vamp may be of patent leather or calf, and the sides of kid, morocco goat or kangaroo. Then, there are the insole of soft leather, the heel and toe stiffening, the back strap, the facing, the tongue and the muslin lining. All the pieces for one pair are tied in one bundle.

Just Watch Them Make Your Shoes

Follow a bundle and see your

A Trip Through a Shoe Factory



Here you see the machine that nails the heel on. When the shoe leaves it, it looks like the insert at the upper left-hand corner.

The workman is here taking the last out of the finished shoe, which is now ready to be dressed and polished for market.

shoes made. The first workman sews only the back seam, the next straps this seam. The third faces the front edges, or sews on the button hole flap. The fourth faces the top and flap. The fifth makes the button holes. The vamp is sewed on.

The Work of the Button Boy

A boy clamps a shoe-upper into a machine, drops the proper number of buttons into a little steel hopper, pushes a lever and in a min-

All Done in Four Minutes

These two pictures show different styles of finished shoes. All this that has taken so long to tell requires only four minutes to do. Wouldn't the shoemakers of a century ago open their eyes at that?

ute out comes the shoe with the buttons sewed on. Eyelets are punched and hammered in, in the same magic way. A boy can sew on five thousand or more buttons a day. But he has to be a bright boy, and mind his work. Careless workmen can ruin delicate machines.

The finished uppers are sent to the soling shop. Into each small machine is clamped a wooden last. The upper is stretched over the last. The edges are lapped an inch over the soft insole that has been tacked onto the last. The welt-strip, shaved thin on the inner edge, and clipped so it can be bent, is curved around the toe, and carried to the heel. Insole, welt and upper are then stitched together and put back on the last. A steel strip or shank is set down the middle of the sole, from the heel to the ball of the foot. When the thick, outer sole is tacked on it is sewed to the welt, outside of the upper. On a new pair of shoes you can see the pretty yellow stitches. The heels are made of several layers of sole leather, nailed together. Machines trim and polish the heels and the edges of the soles. Then the shoes are blacked and polished with whirling wheels and brushes and put into boxes.

"Black Your Shoes Sir?"

What kind of shoes do you want?

"Number two, D last, patent leather vamp, calf top, button, extension sole."

A New Pair Every Four Minutes!

There you are! Just four minutes to make them by the factory clock. The material passed through

the hands of over a hundred workmen. To make a "turned," or single sole kid shoe for a baby or lady, takes a little longer. The upper is put on the sole wrong side out, sewed and turned right side out. That makes a very soft dress shoe.

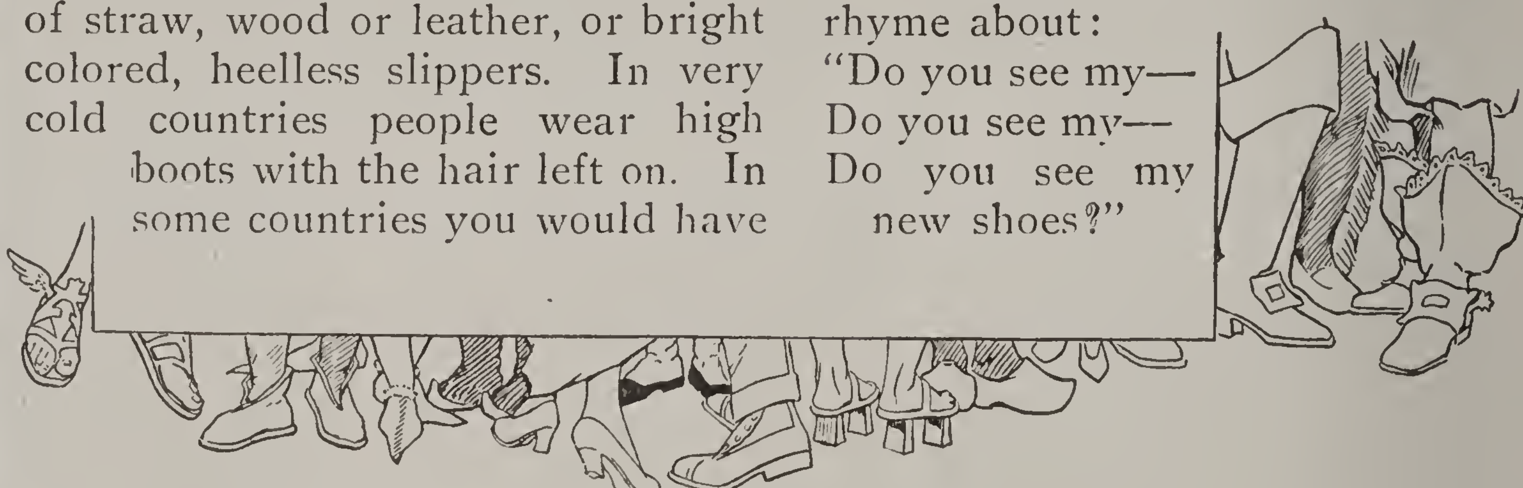
Baby's Shoes Take Longer

No other children in the world have such neat, strong, comfortable shoes as you have. Little Dutch children wear wooden shoes that they have to scrub every Saturday. Japanese children wear straw sandals tied on with strings between the toes. Chinese children have cloth shoes with thick, felt soles. In warm countries everywhere you would find people wearing sandals of straw, wood or leather, or bright colored, heelless slippers. In very cold countries people wear high boots with the hair left on. In some countries you would have to wear soles without shoes, in others shoes without soles.

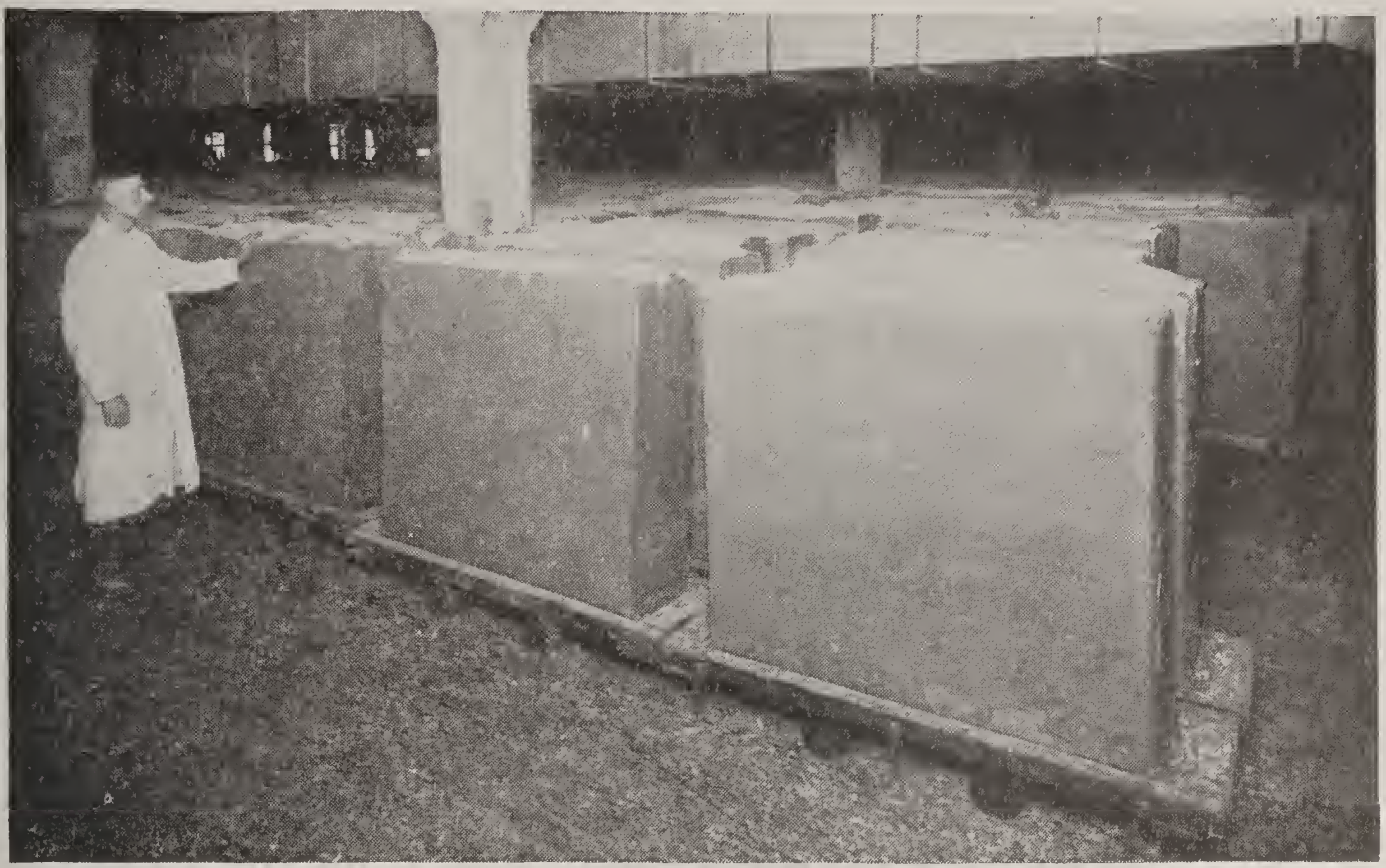
How Shoes Talk History and Geography

The sandal is just a sole held on with straps. A moccasin is a bag, or pouch, pulled around the ankle with a draw string. Don't you wonder who it was that had the bright idea of sewing a sandal to a moccasin and making a shoe? People have always thought so much of their shoes that they put them into stories. There is a story of Puss in Boots, the Giant with the Seven League Boots, Goody Two Shoes, the Old Woman Who Lived in a Shoe, and Cinderella and the Crystal Slipper. It must have been a little princess in sparkling, fairy slippers who invented that pretty heel-and-toe dance that fits the old rhyme about:

"Do you see my—
Do you see my—
Do you see my
new shoes?"



Some of a Shoe's "Queer Relations"



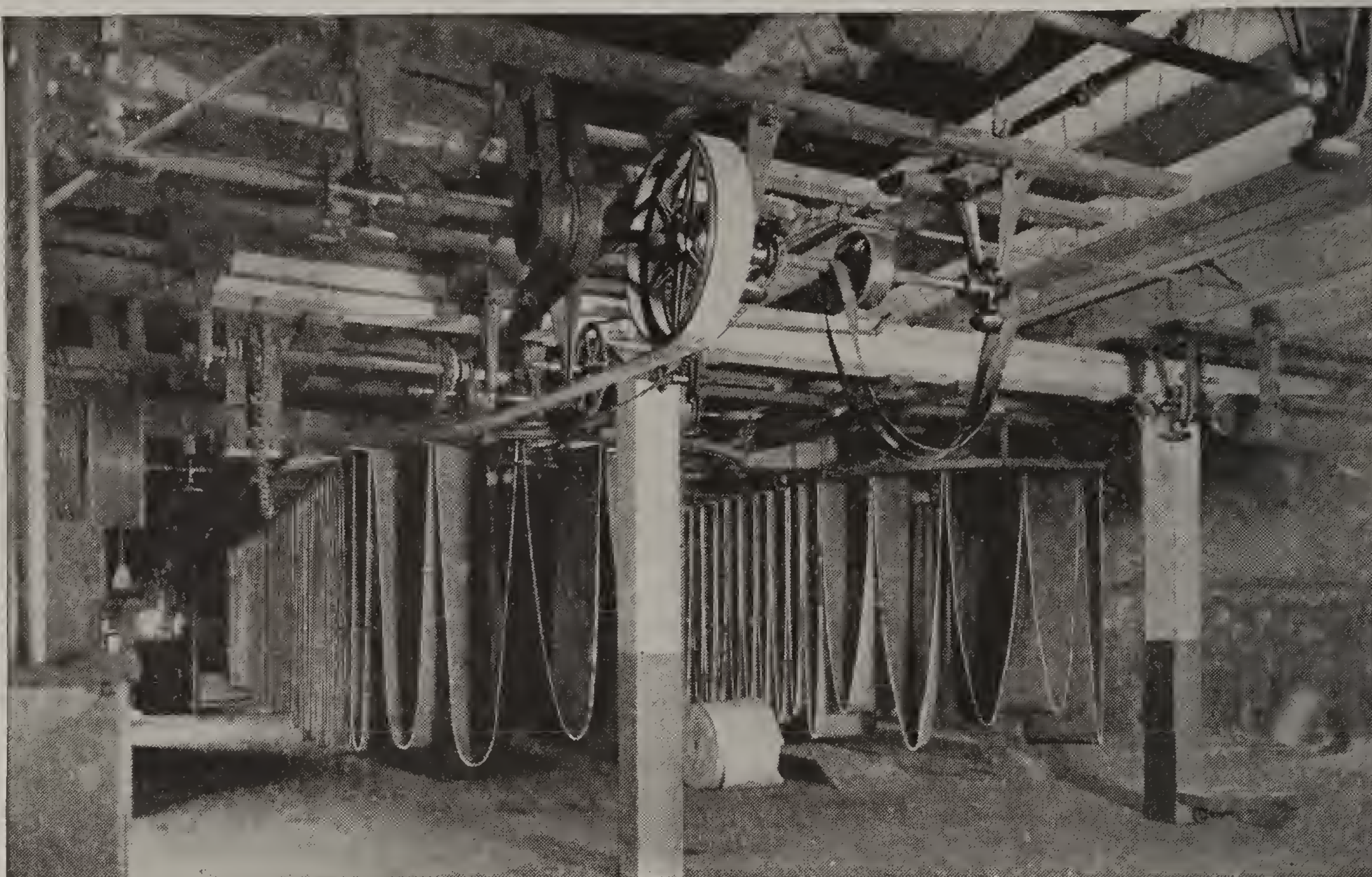
To Wash Many Faces

If you had to guess what these were, wouldn't you say they were slabs of marble? But they're not; they are big pieces of soap, ready to be cut up into cakes. They are made in the stock yards from the fatty waste.

Sheepskin Scraps

These men are trimming off the parts of the sheep hides which cannot be used for leather. They are not wasted, but used to make—what do you suppose?—glue!

Some of a Shoe's "Queer Relations"

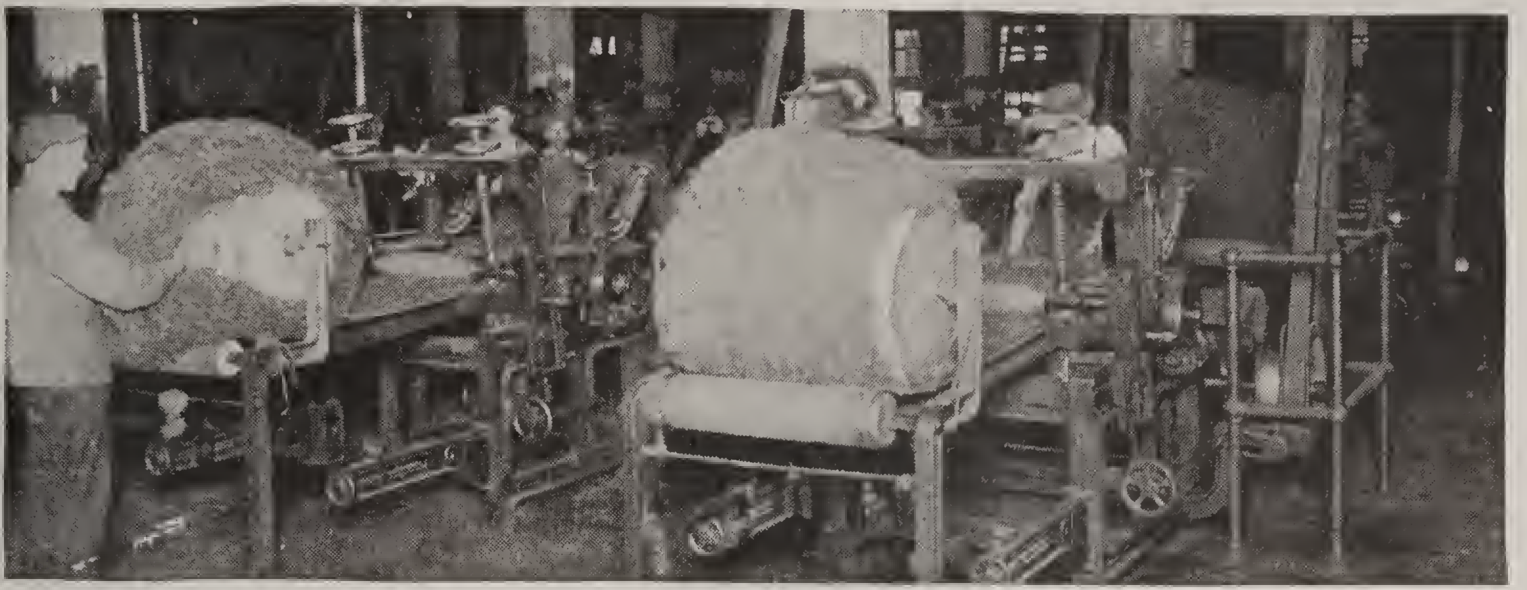


Sandpaper and Fiddle Strings

These are long strips of sandpaper hung up to dry. But, you ask, what has sandpaper to do with cattle or sheep? It is made in the stock yards to use up the hoofs, scraps, and other refuse, which are turned into glue and used to stick the sand to the paper.

This picture shows strings of intestines being stretched and dried. They will be used for violin strings, tennis rackets, surgical ligatures and many other things.

Some of a Shoe's "Queer Relations"



This picture shows the big roller machines that prepare the hair for curled hair mattresses and furniture.

The girls in this picture are cutting buttons and pipe mouthpieces from bits of the shin bones of cattle.

Here are thousands of "bone" hairpins being made out of the split and flattened horns and hoofs.

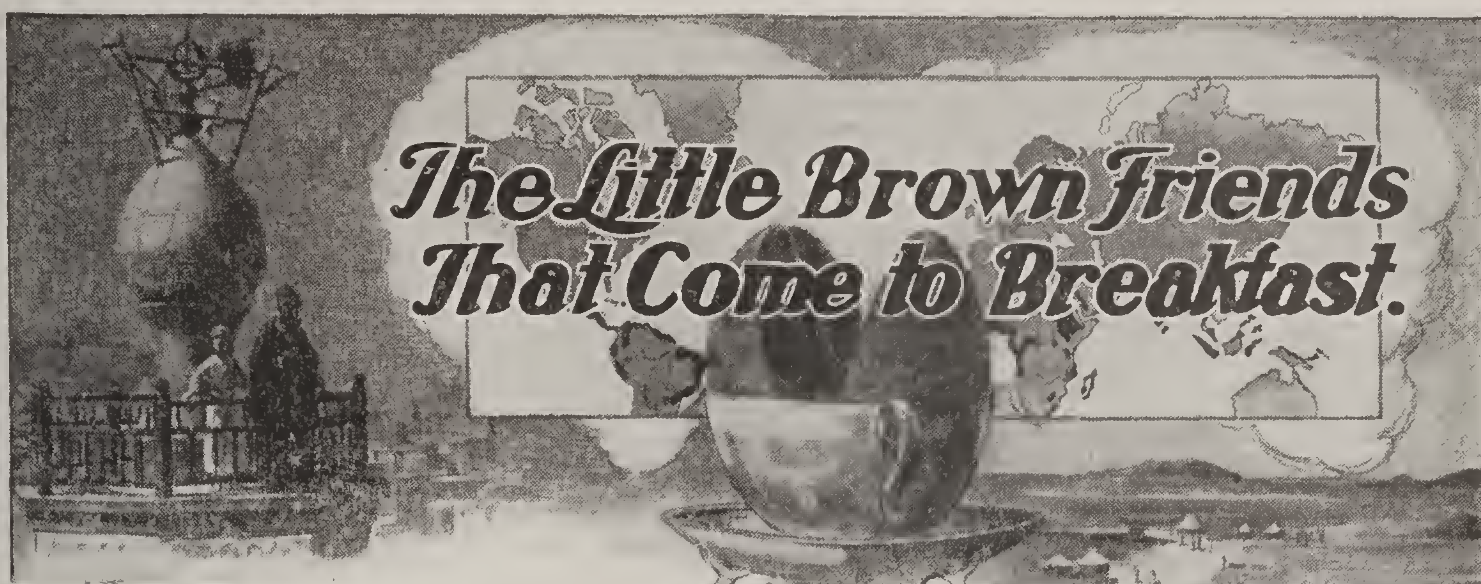
What Becomes of the Hair?

In this picture the hair and wool is being scraped off from pelts and sorted ready for cleaning.

Little Shoemakers

After the earliest pioneer period when the mothers made the moccasin shoes for the children, there came a time when the colonists had shoemakers' tools, and shoes like those we wear today were made by the fathers in the home. Then came the shoemakers, and finally the big shoe factories.

These children are showing, in their physical exercise, how the old shoemaker used to make and mend shoes. If you want to try this exercise, kneel on your right knee, put your left hand closed tightly over the shoe, which you hold on your left knee. With your right hand pick up a shoe peg. On the count "One," pick up the shoe peg; "Two," place it in the shoe; "Three," drive it in with the hammer in your right hand.



The Little Brown Friends That Come to Breakfast.

THE picture on the left is from the painting "The Call to Prayer" by Gérome, the famous French artist who in his pictures has given us such true and interesting accounts of Eastern habits, Eastern thought and Eastern art. The muezzin or priest and his boy helper, in order to get to the dizzy top of that minaret had to climb up a shaky ladder exposed to the wind; and this, until you get used to it, makes you feel shaky too.

On the top of the minaret you see the crescent, the sign of the Mohammedan faith. The Mohammedans consider it a sacrilege to have birds sit on this sacred emblem. Yet it is a part of their religion to be kind to animals. So they provide roosting places for the birds around the crescent, but for fear the bird visitor may not take the hint the crescent is fixed with swinging weights to switch him off. This device just as much as says: "Don't you see that perch?" The muezzin is here calling to prayer just as he did when they first began to use the coffee berries to keep awake during the long services in the mosque. Of course, you know what those two berries are in the cup. The map with the steam from the coffee cup behind it shows the coffee regions of the world. Our story of coffee will tell you about the two little Arabians who are carrying it and the people making the journey to Mecca shown on the right.

THE STORY OF COFFEE

In the Ancient House in Mecca

HUNDREDS of years ago, the children of Arabia knew, as well as we know today, that it is not good manners to go to sleep in church. When in their tent home in the desert, "church" was just a bright prayer rug, spread anywhere on the sand. But once a year the whole family made a pilgrimage to Mecca. They went to sell the goat skins and camels' hair, and to buy what was needed in the great fair. But, also, they went for the week of prayer.

During the long services in the Ancient House, or sacred mosque, it was hard for the children to stay awake. So their mother gave them some little seeds to eat to keep them from becoming drowsy. They had one round side, and one flat, grooved side. They were crisp and spicy and a

little bitter. They came from a small tree that grew wild on the mountain slopes of Kaffa, Arabia, above the sea. Mahemet and Naidee called them Kaffa bunns, or seeds. We call them coffee beans.

The "Keep Awake" Medicine in the Kaffa Bunns

The Kaffa bunns had in them a medicine that kept people awake.

Coffee Drinking in Coffee Land

In Mecca, pilgrims wanted to stay awake as many hours as possible; so everyone carried the roasted seeds to nibble. Somebody discovered that a pleasant drink could be made by steeping the powdered seeds in boiling water. Soon there were coffee booths in the market, and near the mosque. For a small coin anyone could buy a cup of very hot, thick, black coffee, sugared until it was as sweet as syrup. People drank that because they liked it.

From Mecca, the Kaffa bunns were carried to India, Egypt and Turkey. The new drink was offered to guests in the Sultan's palace, the merchant's house and the shiek's tent.

How Mocha Coffee Gets to Market

As you look at the picture "How Mocha Coffee Gets to Market" just

Discovering the Coffee Farmer

imagine that you are a traveler and have suddenly come upon this group without knowing anything about them except that they had brought these bags of Mocha coffee down to the water's edge for some passing vessel. You would ask yourself: "Who are these people? What water is this and what are they doing here?" Now, in your own library you can have all the delightful experience that a little girl did who played traveller with her mama and helped her to find

How Mocha Coffee Gets to Market

how Mocha coffee got to market, we turned (as you should do in reading this) to the map of Asia and there found Mocha spelled "Mukha" and that it was right near the narrow strait leading into the Red Sea. The map also showed that there are low mountains from this point all the way to the north end of the Red Sea. That accounts for the steep banks shown on the farther side of the water beyond the group. These steep banks rise to the low mountains on whose slopes the best coffee is grown. But who are the people? The little girl remembered that there were pictures of the faces and head-dress of all sorts of Asiatic peoples in one of our encyclopedias. The very thing! She looked and there was a man with his hair done up just like the hair of the man in the picture. The book said he belonged to the Hodeidas and that the Hodeidas were a tribe settled on lands which they cultivated. So evidently this is a Hodeida coffee farmer and his family. The Arabs of the desert, on the other hand, are warriors with wandering herds of sheep and camels and they look down on these farmers who live by the cultivation of the soil. When they get a chance they rob them, so you see why this farmer has that dagger in the sheath on his arm. Did you ever see a sheath carried in this way before? It isn't the way the old knights used to carry their swords, is it?

Queer People We Found by the River

This Arabian coffee farmer is waiting for a ship on its way through the strait so that his coffee can go on to be sold to the wealthy people who can afford to buy Mocha coffee in London, Paris and other great cities of Europe and America.

When coffee houses were set up in London and European capitals, not nearly enough coffee could be grown in Arabia to supply the demand. And coffee refused to grow in colder northern countries.

How Mr. Kaffa Bunn Came to America

Just about that time many ships were sailing to the New World of America. Every ship bound for the warm islands and coasts around the Gulf of Mexico and Carribean Sea, brought seeds of cotton, sugar cane and coffee. A Dutch captain planted a handful of coffee beans in Dutch Guiana, South America. Returning a few years later, he found just one fine little coffee tree. He may have found it by following his nose. Three miles out at sea he could have smelled its rich fragrance, like that of the jessamine or, as some say, the white, sweet-scented honeysuckle.

You Can Smell the Coffee Growing too!

It was a gay little pilgrim, not at all like the sober children who came to cold New England on the Mayflower. As bright of plumage as a tropic bird, it spilled its perfume on the warmest air, of the bluest sea of the new world. As tall as a big lilac bush, it was as slender as a birch. Its evergreen leaves were six inches long, shining as Christmas holly and tough as rubber leaves. From the axils of the paired leaves grew clusters of snow white, five-parted tubular flowers. The humming birds had found that insects and honey were in the bottoms of the tiny trumpets. These jewels of the air darted and hovered all over the tree, and poked their long, needle bills into every little

The Gay Little Pilgrim

The Coffee Plant Likes to Look at the Sun

The coffee tree, like the sunflower, is very fond of sunshine, so its leaves are supported by strong stems in stiff, straight rows, each one having as much surface exposed to the light as possible. See how the leaves all face one way—the direction from which the sun is shining—like soldiers in rank.

flower flagon of honey-sweet nectar.

Blooms Every Day for Months

There were not only blossoms on that tree, but green and red fruit, making it a lovely thing to look at. The flowers of the coffee tree fall in two or three days, but new ones open every day for four or five months. The green fruit turns pink, then scarlet, then crimson. A northern robin would be sure to think the coffee berries were cherries, or haw apples or cranberries. But if he should eat them he would be apt to have a pain in his little inside. Coffee is not good for little birds and little boys and girls. The pulp is soft and yellow. But the two seeds that lie with their flat, grooved faces together, are as tough as horn, and they have a skin as tough as the nest of the apple seed.

What a Robin Would Probably Think

Where Mr. Kaffa Bunn Likes to Live

That one tree, planted about two hundred and fifty years ago, is said to be the grandfather of all the coffee trees in America. Its seeds were carried to the warm coasts of South and Central America and Mexico, and to islands of the West Indies. It refused to grow in some places. It liked the same temperature as human beings—from sixty-four to seventy by the thermometer. A mountain side, half a mile or so above a warm sea, just suited it. The soil had to be clean and sweet, red with iron dust or gray with rich mud washed down from old volcanoes. It would grow on both sides of the equator, in the old world

The Grandfather Who Helps Mama Get Breakfast

and in the new, on mountainous islands and coasts. The little trees flourished in Java and other islands of the East Indies, in the Philippines and the volcanic islands of Hawaii. But the largest tract of country good for coffee culture was found in Southern Brazil.

A Berry-Laden Coffee Tree

© *Keystone View Co.*

The small, graceful coffee tree is particularly pretty when its slender branches are weighed down with fruit as in the picture. The leaves are bright green and glossy while "the green fruit turns pink, then scarlet, then crimson."

"Finger Trips" to Coffee Land

Run your finger down the east coast of South America past Rio de Janeiro to the seaport of Santos. You have seen the names Santos and Rio on coffee bins in groceries, haven't you? The city of Santos is the greatest coffee market in the world. It has great coffee warehouses that hold as much as wheat elevators. Its harbors are full of coffee-carrying vessels, that float the flags of many nations.

Notice When You Go to the Grocery

Just behind Santos is another city, San Paulo. This is Portuguese for St. Paul. San Paulo is the receiving station for the coffee that comes from the north, south and west. From there, and from hundreds of miles along the coast, the land climbs and climbs, in a gentle slope, to a great plateau. The seaward slope is broken by round hills and broad valleys. Above them rough sierras, or low mountains, rise from the plateau. Exactly on the Tropic of Capricorn that would be a very hot country, but, high above the sea and guarded by a mountain wall, it is as moist and pleasant as a properly heated and ventilated school room.

From San Paulo you can travel on cog-wheel railroads, all over the coffee country, climbing hills and dropping into valleys. There are few towns. Mile after mile is mantled with trees as green as emerald. Dividing the fields are roads as red as a brick yard—a glaring, terra-cotta red, from the quantities of iron dust that is in the soil. The air is heavy with the fragrance of coffee blossoms. You wonder why they don't try to catch that perfume and put it in bottles!

Air Sweet Enough to Be Bottled

Why Coffee Trees Are Like Babies

The coffee trees are started in nurseries, like the tea bushes, and transplanted like orchard trees, but much closer together. For a few years the young trees have to be

On a Coffee Plantation

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At the left the ripe coffee berries are being picked, at the right they are being carried home on the heads of the pickers. Coffee plantations are usually large, some of them having as many as five million trees. As on big cotton plantations in the South, the coffee workers live in houses belonging to the plantation owner, trade at his store, and sometimes spend their whole lives on the plantation. Each family has its own quota of trees—from one to three thousand, and the members of the family are expected to take full charge of the trees in their care, from planting to picking.

weeded and hoed by hand. Then the plow is used to turn up the soil, as in a corn field. Some planters think the trees grow better when they are allowed to reach their full height of twenty feet, but

Coffee Raising in Central America

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In the picture on the left Nicaraguan girls are sorting coffee. Nicaragua encourages people to raise coffee by offering a bounty of five cents on every tree over five thousand.

The other picture shows Costa Ricans turning over the green coffee berries. This must be done frequently so that the coffee will dry evenly. Costa Rica's climate is ideal for coffee growing.

Here Comes Our Breakfast Coffee

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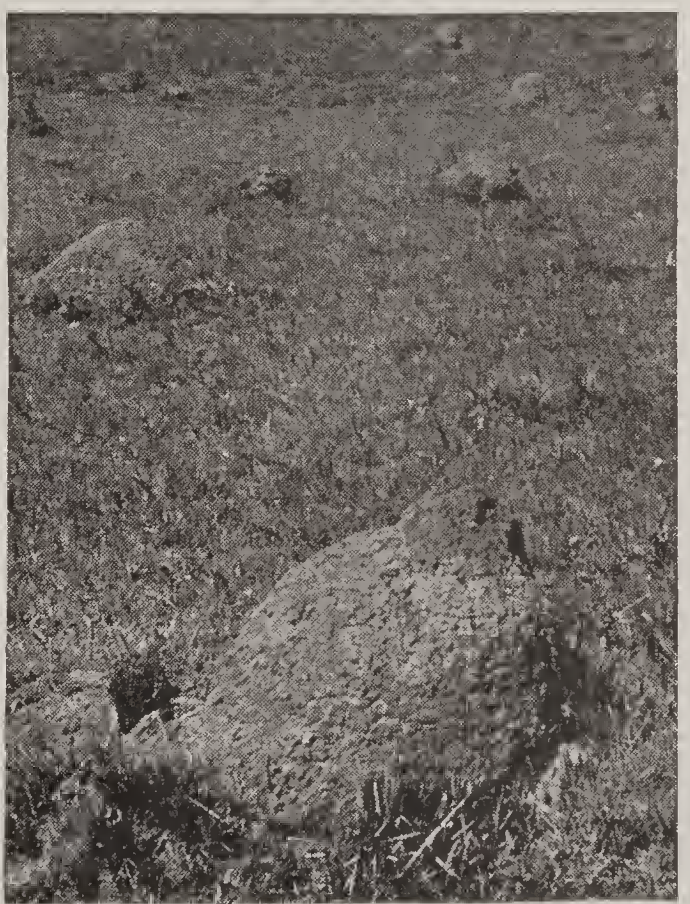
At the left, sacks of coffee are being unloaded at Havana, Cuba. In the righthand picture a loading machine is delivering sacks to a vessel alongside the docks at Santos, Brazil. Santos is the greatest coffee city in the world. It has many storage warehouses for coffee and excellent wharf accommodations. In its harbor, ships from all nations of the globe may be seen taking on cargoes, as this one is doing.

most growers trim them back to stocky bushes, six or eight feet high. If cared for, a coffee tree will live for fifty years and give three or four crops in a season.

In a coffee orchard that is in bloom and fruit, there is always a buzzing and humming and fluttering of birds and butterflies and insects, and armies of red ants marching and countermarching from trees to ground nests. The ants bite the pickers sometimes, but they are friends of the trees, biting the coffee bugs and the coffee rat that gnaws the bark.

Homes of the Coffee Grower's Little "Policemen"



© *Keystone View Co.*

These are the homes of the ants that help the coffee-grower by biting the coffee bugs and the coffee rats. Like all tropical countries, Brazil has a very large supply of insects. The ant hills in the picture are three feet high and a foot and a half in diameter.

How the Children Help

The pickers do not usually carry baskets or bags. They spread a sheet on the ground, around a tree, and drop the red fruit on that. They pick only the berries whose dark redskinshave begun to wrinkle, like an over ripe cranberry. They go over all the trees every two or

four weeks all winter. South of the equator, you know, the Fourth of July comes in the winter, and Christmas in the summer. When coffee was taken to Brazil it had to learn a new order of seasons. Men, women and children work in the field. They are dark-skinned, black-eyed, scarlet-lipped Spanish people, whose language is like music. Some are native Indians or free Negroes. The children sit on the ground to strip the lowest branches. When the trees are tall, men use ladders to reach the highest branches.

The Plant That Masquerades as Coffee

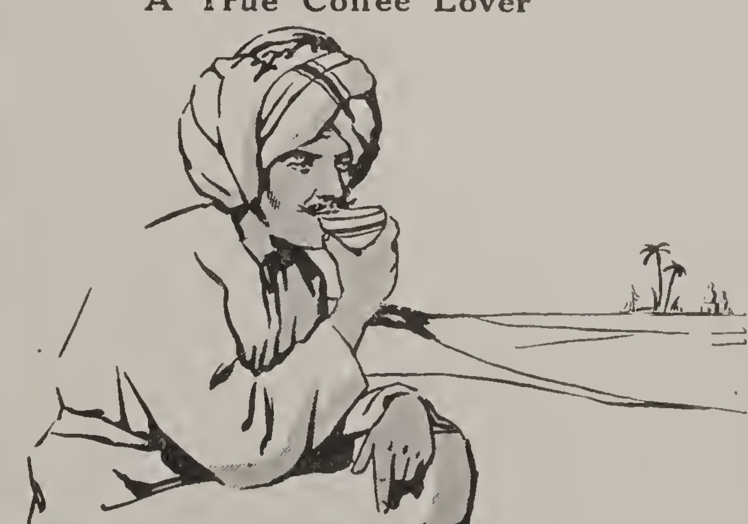
Chicory grows wild in many parts of the United States. Its root, roasted and browned, makes a drink that looks and tastes like coffee, except that the delicacy of flavor or aroma is missing. Chicory does not contain caffeine, the drug in the coffee that makes you stay awake.

How the Twins Are Sent to Mill

Other men rake the berries from the sheets and put them into bags or baskets. On some plantations the hauling is done in mule carts; but on the very large ones there are private railroads, with cart-like cars pulled by locomotives. A train loaded with the fruit rushes away to the mill.

The berries are emptied into great hoppers, are "squashed" between rollers to mash and loosen the pulp from the seeds. The seeds drop through holes and are carried to tanks where they are scoured by machinery. The two seeds separate. Each is as white as a navy bean. It is inclosed in a thin skin. This skin is as tough as celluloid.

A True Coffee Lover



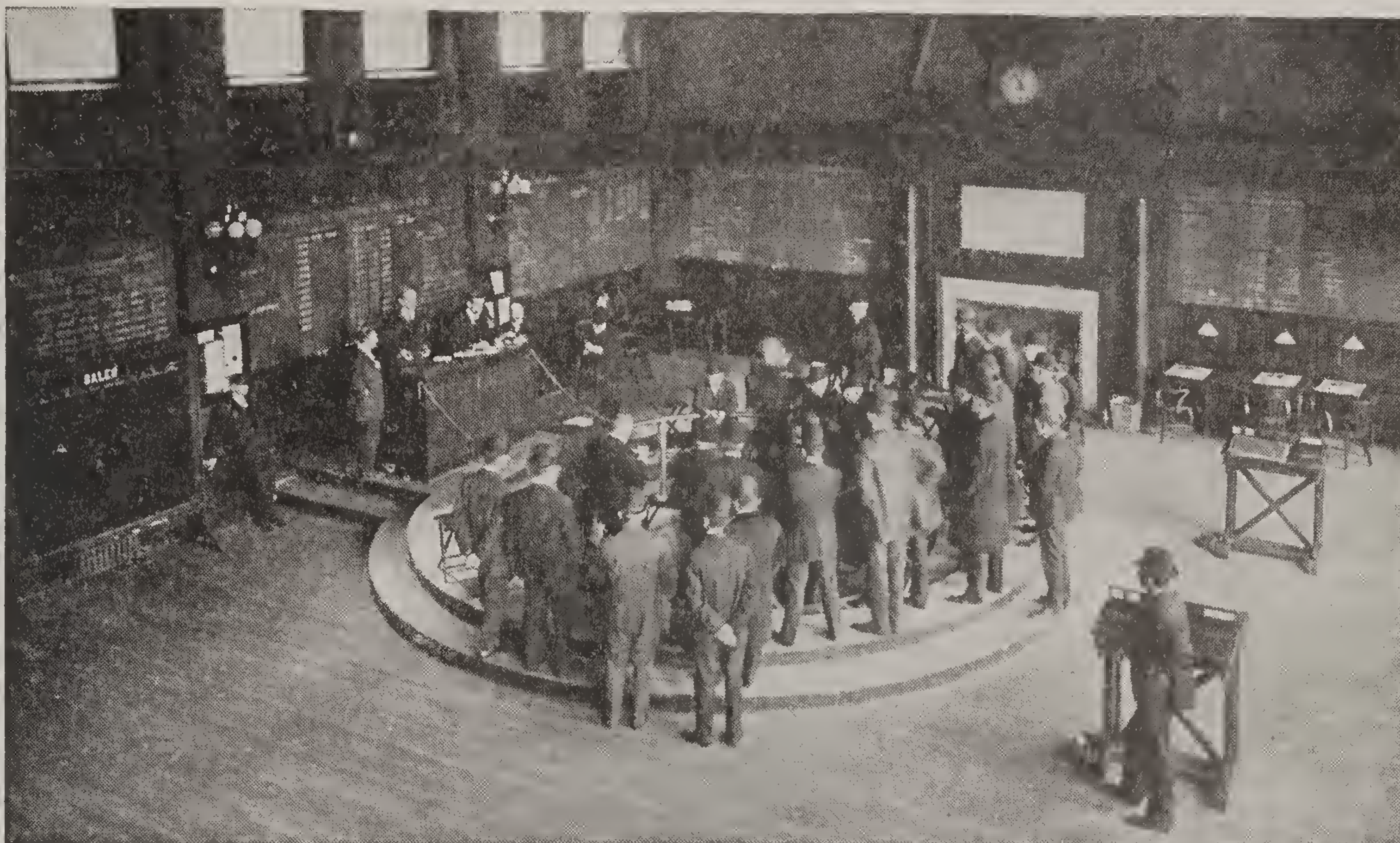
This is an Arab, squatting in the desert, sipping the delicious beverage that was discovered by his ancestors.

How Many Suits of Clothes These Little Seeds Wear!

Umbrellas for the Coffee Berries

The white seeds are spread in the sun, on yards paved with brick or tile or cement, to dry. It takes several weeks to cure them properly. The heaps of seeds are raked and turned over every day. They are covered at night, with canvas, and protected from rain. When perfectly dry there is a great nut cracking. The white hulls are broken between rolls run by steam, and the grayish green seeds fall out. There is another silvery skin, as thin as tissue paper, that is rubbed off and blown out,

New York Coffee Exchange



© Brown Bros.

The picture gives you a glimpse of the brokers buying and selling coffee in the New York Stock Exchange.

like chaff from a threshing machine. The seeds are sorted, in uniform sizes, by sifting. They are shipped to Santos in brown bags.

The Different Kinds of Coffee

You can buy many kinds of coffee in groceries—Mocha, Java, Rio, peaberry, Porto Rican and Santos. But you must not think that all Mocha coffee is from Arabia, or Java from the East Indies. All varieties are grown in Brazil and the West Indies. And there is a very great difference in the quality and price. A mixture of one-third Mocha and two-thirds Java is very fine. If you buy the green berries, the round, plump, small ones are better than the large, flat seeds. When the coffee is roasted the quality can be told by smelling, if you have an educated nose. The finest coffees have a rich aroma.

Why Coffee Is Glazed

People used to buy coffee green and roast it themselves, but found it hard to brown it evenly without scorching it and spoiling the flavor. Now coffee is roasted by wholesale

Here is an American soldier boy holding his steaming coffee pot over a little campfire.

grocers and coffee houses in big iron cylinders that turn over a fire and most people buy it already browned. The seeds are tossed about in a uniform heat. They are glazed, while hot, with a gum or syrup, to shut in all the flavor, then sealed in air-tight tin cans. When you buy a can the grocer will open it and grind the coffee for you in a tall, red iron mill. You should not buy coffee already ground. That is easily adulterated with chicory root and doesn't keep its flavor so well as the unground.

How to Test Coffee

To test coffee for purity, drop some that is ground into a glass of cold water. Coffee is light and has oil in it, so it floats. It colors the water very slowly. Chicory and other roots and grains, sink at once and dissolve in the water.

Why You Have to Settle Coffee

Even in boiling water coffee has to be "settled" to the bottom with a white of egg. We like our coffee a clear, rich brown, with cream and sugar added. The French people use hot milk in very strong coffee. Some people boil coffee, some drip it. Both ways are good. Turkish people grind their coffee as fine as flour and drink it thick and black and sweet.

Afternoon Coffee in Turkey

© *Taber Prang Art Co.*

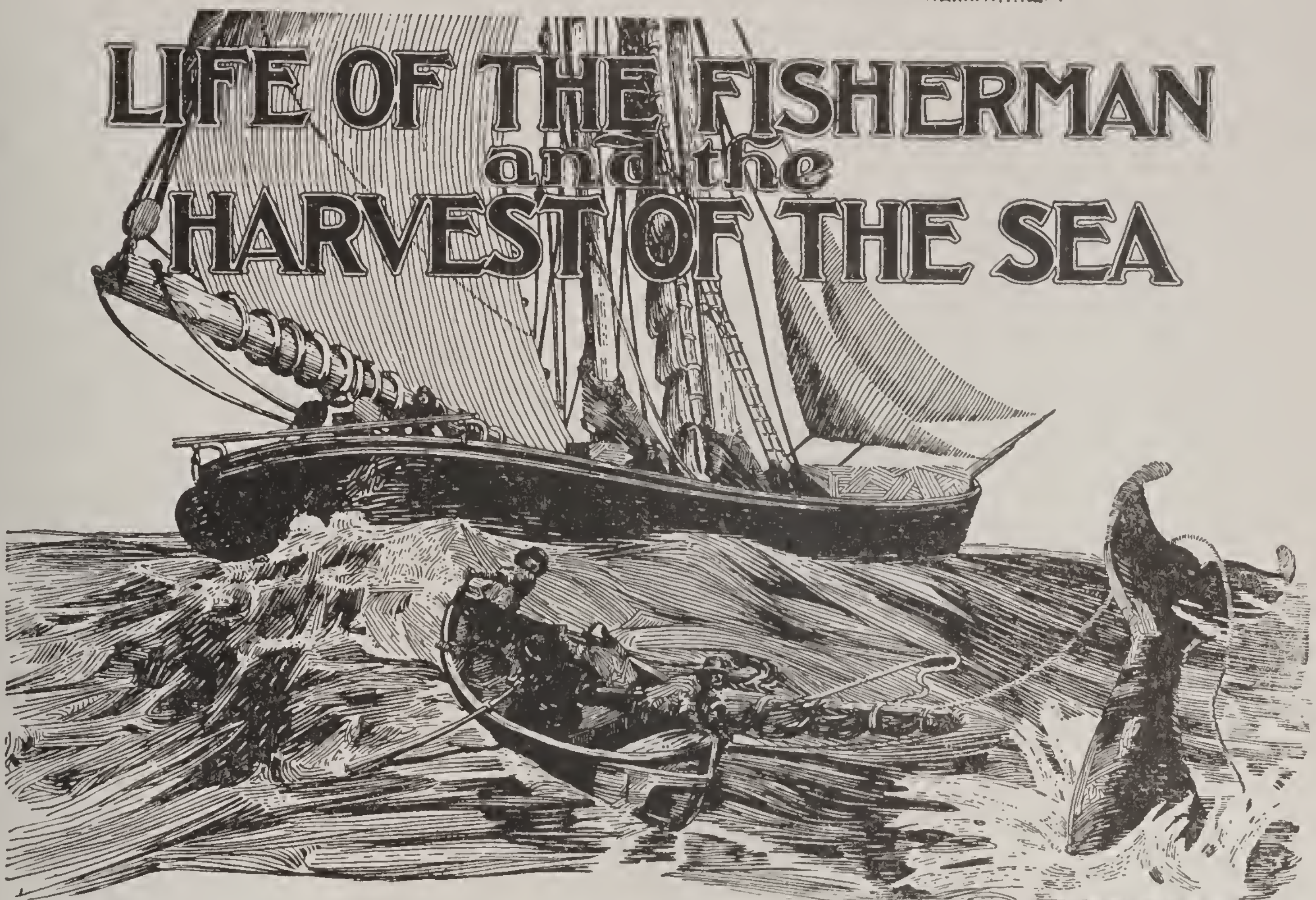
In the center a Turkish gentleman is entertaining a guest with a cup of his choicest Mocha. The guest, no doubt, is complimenting his host on its flavor with true Oriental flattery.

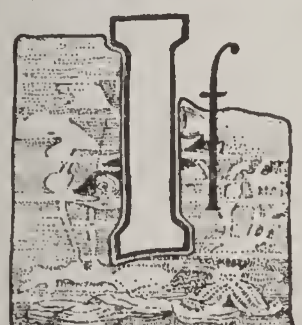
Coffee Given Away That Is Too Precious to Sell

Pilgrims to Mecca still get little cups of coffee, made in that way, in the market and near the mosque. Travellers say it is the finest coffee in the world. But then, it is a pure Mocha, of which there is very little. The sultans, merchants and shieks serve their coffee to guests, but they will not sell it.

What Sultans Serve Their Guests

LIFE OF THE FISHERMAN and the HARVEST OF THE SEA





If you were going fishing, where would you go?

Perhaps you think that a foolish question. Fish live in the water, of course. So wheat grows on land; but you would not expect to find wheat in every field, would you? If you fished in some rivers, lakes and seas, you would have no luck, or you would catch things that you could not eat. There is no doubt about what you would take with you. Hooks, lines and nets, are the fishermen's tools in all the waters of the world.

Camping in the Water

The very largest fishing boat that sails is just a rough, water camp. There is a cook on board.

The men sleep in bunks and wear rubber boots and oilskin coats and hats. The inside of the boat is divided into bunks, bins for salt, bait, fishing tackle and fish.

Bidding the Fishing Fleet Good-Bye

When a big fishing fleet leaves port, everyone in town comes down to see it off. The boats may be gone for three months. Some of the men may never come back. A fisherman's life is one of hardship and danger. There is a beautiful, sad poem by Charles Kingsley called "The

A Life of Hardship and Danger

Three Fishers." It is all about how "men must work and women must weep," of boatmen that never come back, and storm waves that moan over the harbor bar. The men kiss and cling to their dear ones, and wave from the deck. The women and children watch from the shore until the last sail disappears. They remember the brave men who are out in the fogs and storms on the fishing banks. Grandfathers and small boys are the only men left in a fishing village.

How do men know where to look for their harvests of the sea? You know that out of all plants on the earth, only a few kinds are good to eat. So it is with land animals and fish. The chief food fishes of the sea are cod, herring and mackerel. Haddock, halibut, blue fish and pilchards, or "sardines" are caught in great numbers, too. Salmon and shad spend a part of their lives in the ocean, a part in rivers. Of fresh water fishes we like white fish and trout best, but eat a great many bass, perch and sturgeon. And then there are oysters, crabs and other shell fish.

Where the Sea is Harvested

Taking the Fish Off the Roof

Fishing is the chief industry of Newfoundland and a large proportion of the fish caught there are cod. Here you see how the fisherman's wife dries the catch. Did you ever dry walnuts on the woodshed roof? After drying in the sun all day, the fish are taken in at night and put into a dry shed. Mother is here collecting the codfish from the family roof at nightfall, just as she takes the washing off the line.

These Fish Know Their Geographies

In one way the sea fishes that we know best are like birds. They come north in the summer. Just as wild geese and ducks stream across the sky in great flocks, so cod and herring and mackerel swim in schools. In the spring mackerel appear off Cape Hatteras and swim, a

The Fog Warning

Fishermen can read the weather signs from the sky and water almost as easily as you can read the weather man's predictions in the newspaper. The sky, overcast with dark, angry-looking clouds, and the white-capped waves tell this fisherman that rough weather is coming, so he has drawn up his anchor and is pulling hard for shelter. He is watching the sky rather anxiously, perhaps wondering if he can reach safety before the storm breaks. The artist who painted this picture, Winslow Homer, is noted for his pictures of the sea.

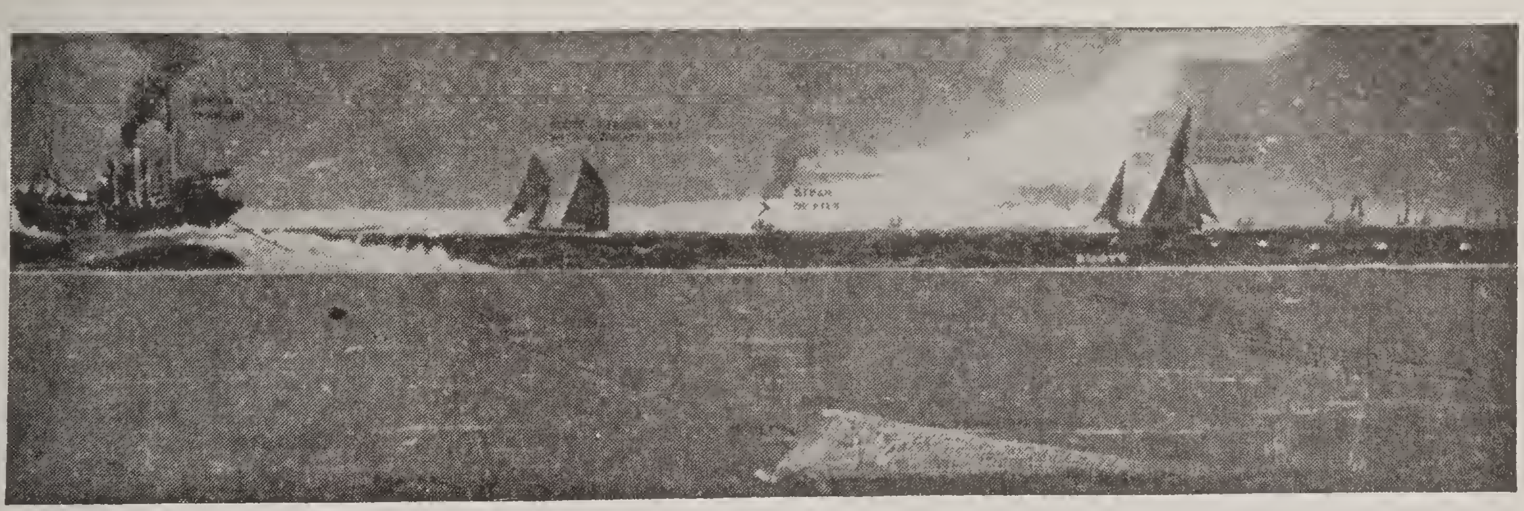
wide river of fish, up the eastern coast to our country. The fishing boats of New England go south to meet them, then follow them clear up into the

Migration of the Fish

old world they go to shallow waters west of Norway. In the new world they collect on the "grand banks" off New Foundland.

In the fishing seasons these places

The Nets at Work



If a diver could see under water as well as in the air, this is how trawl and drift nets would look to him. "The trawl is a bag net, one hundred feet long, lined with pockets of finer netting." The "trawl warp" in the illustration is a stout manila rope. "For the smaller fish that swim nearer the surface, the drift net is used. The lower edge is weighted with sinkers, the upper is floated with cork and wooden buoys." The picture also shows several different types of fishing vessels, both steam and sailing craft.

Gulf of St. Lawrence. In the old world the mackerel gather on the south coast of Norway. Cod and herring travel together, the big cod far below the small herring. In the

are dotted with sail boats of many nations. The fishing is done from small row boats. Each boat is in charge of an old fisherman who de-

How the Sea Birds Help

Packing Herring on the Coast of Scotland

Herring are dried and salted, then packed for shipping. In this form they are part of the stock in trade of grocery stores everywhere. The picture shows women filling up barrels with them at Fraserburgh, Scotland.

cides where to let down the nets. He watches the sea birds that follow the fish and dive for those that come near the surface.

The Different Kinds of Nets

There are just three kinds of nets—the trawl, the drift net and the seine. The trawl is a bag net, one hundred feet long, lined with pockets of finer netting. The mouth of the bag is held open by a beam of wood that rests on iron stirrups on the ocean floor. As it is trawled or towed by the boat, the bag is spread open by the weight of the water. Big cod, haddock and halibut, that swim deep in the sea are trapped in the pockets.

On the Cold, Gray North Sea

Here is a North Sea fisherman hauling in his lines of jumping, squirming fish, at the end of the day.

For smaller fish that swim nearer the surface the drift net is used. Imagine a tennis net from one to two and a half miles long! The lower edge of it is weighted with sinkers, the upper is floated with cork and wooden buoys. The end of a drift net is "shot" out from a

boat. Then the boat is pulled away, letting the net out as it goes. A little flag at the far end, and colored buoys strung along the top, show just where the net is. The fish swim against this wall of netting and are caught by the gills in the meshes.

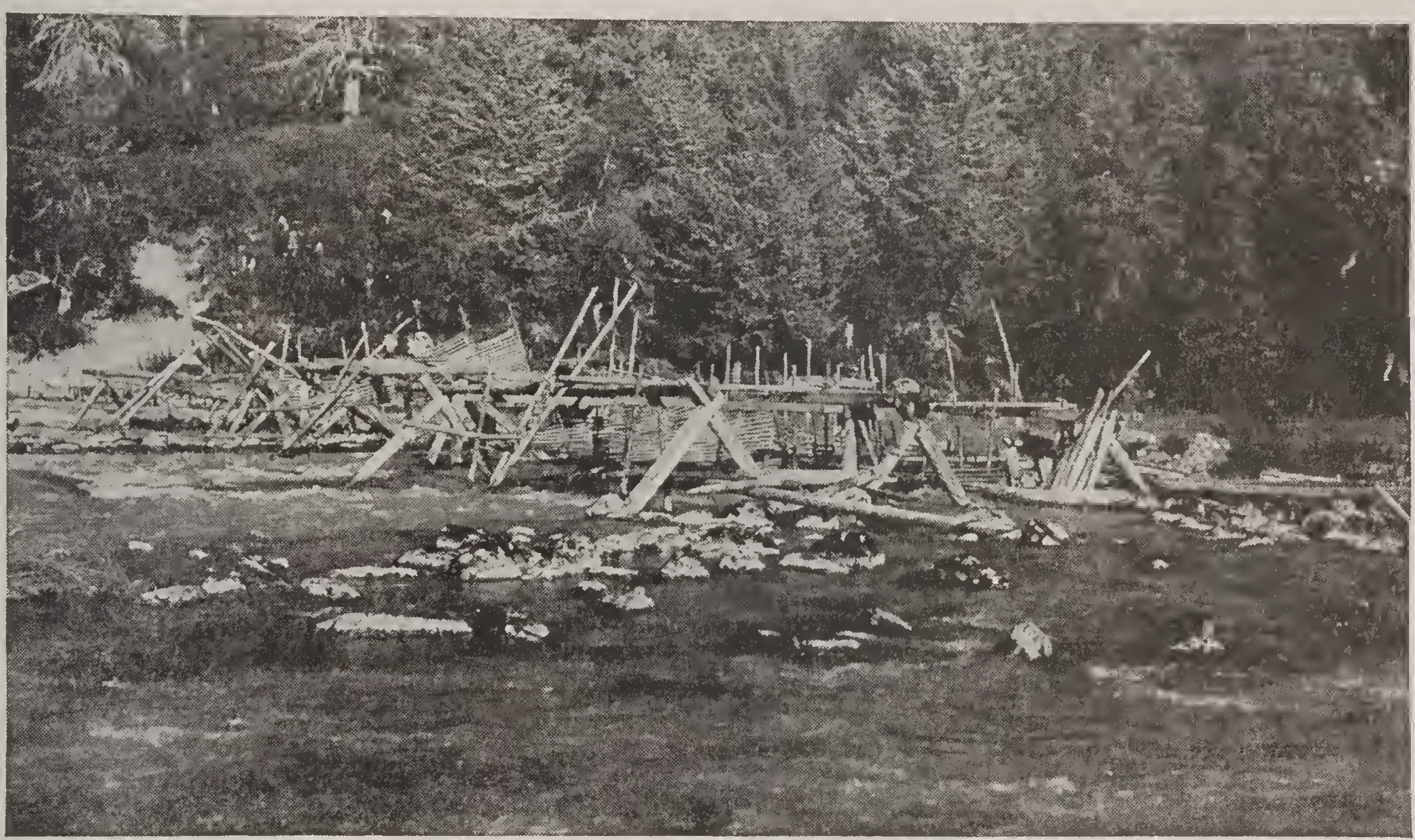
Seines are short, wall nets not over five hundred feet long. They are used for fishing on coasts and in rivers. They are let down outside a school of fish. Slowly and quietly the ends of the seine are brought together. The seine is then towed shoreward until the lower edge rests on the bottom. The fish are thus trapped in a net tub.

"Fancy Work" of Fishermen's Wives

Fish-nets are knitted in long, narrow strips, and laced together. The best ones are knitted of cotton twine, and by hand. The "fancy-work" of fishermen's wives and daughters is knitting miles of nets. The men spend their spare time on shore mending the nets and drying them on reel frames. If left in wet heaps they would rot. Trawls are torn on the rough sea floor. Big fish tear the nets in their struggles. Dog fish bite them. Sometimes a steam boat is blown out of its course and goes over the "banks", tearing the nets to pieces. Then, with constant wetting the nets shrink. A shrunken herring net can be used to catch sardines in the English channel, and the tiny herring on the coast of Maine, that we use as sardines.

Troubles the Nets Have

Wooden Fish "Nets"



The Eskimos and Indians long ago discovered how the salmon "get homesick" and come back every spring to the cold, fresh water where they were born. The Indians build traps or "nets" of small boards, like zigzag, ramshackle fences, across the streams. The picture shows one of these structures built across the Chilkoot River in Alaska. Though this is a small stream, as you see, enough salmon are caught in this way to keep the Indians supplied for several months.

How the Fish Are Preserved

Fish that are wanted fresh for the market are packed in ice. Sardines are brought in to the canneries as fast as they are caught. When the boats stay out for weeks, the fish

Catching Chinook Salmon with a Seine

© *Underwood & Underwood*

"Seines are short, wall nets used for fishing on coasts and in rivers. They are let down outside a school of fish. Slowly and quietly the ends of the seine are brought together. The seine is then towed shoreward until the lower edge rests on the bottom. The fish are thus trapped in a net tub." Chinook salmon are the biggest variety known and here we see men fishing for them with a seine in the Columbia River, Oregon. The teams of horses were used to haul in the net. The floating wooden blocks you see are strung along the rope at the upper edge of the net to keep it afloat.

Emptying a Salmon Trap

© *Underwood & Underwood*

This squirming, wriggling mass of salmon was caught in the net trap from which they are being emptied. The fishing boat is a small one on Puget Sound.

Cleaning Codfish

© *Underwood & Underwood*

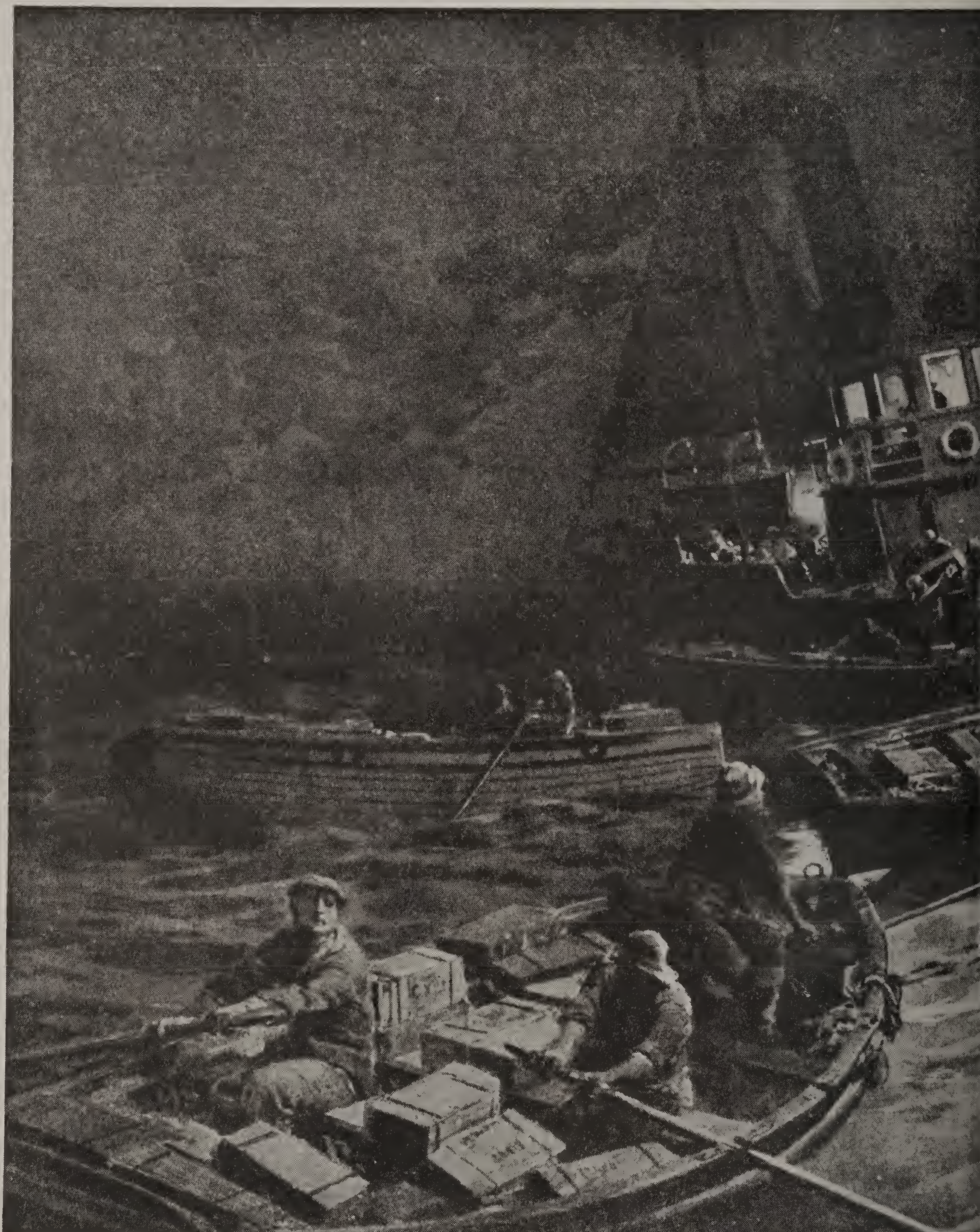
"Cleaning" fish isn't such a delicate and particular job on this Gloucester, Massachusetts, wharf as it is in your kitchen. Vast numbers of codfish are cleaned here every day during the fishing season.

In a Norwegian Fish Warehouse

© *Underwood & Underwood*

The woman in the foreground has just brought in a wheelbarrow full of cleaned fish from a fishing vessel nearby. They will be weighed in the rude scale which you see hanging from the ceiling by ropes, then shoveled into the packing box by the woman at the right. The fishing industry is one of the largest in Norway.

Loading Fish



On the Dogger banks off the northeast coast of England where many fishermen are working at once, a steam carrier. Here we see the loaded dories drawing up alongside the steamboat. The boxes of fish a great saving of time for the fisherman. The steam vessel is swifter than the fishing craft, and when it his load to port.

for London

each fishing boat packs its catch in salt and ice, loads it in boxes on "dories," which take these boxes to
are being handed up over the side of the steamboat and will be in port by morning. This arrangement is
takes the fisherman's catch ashore for him, he can spend all his time in fishing instead of stopping to haul

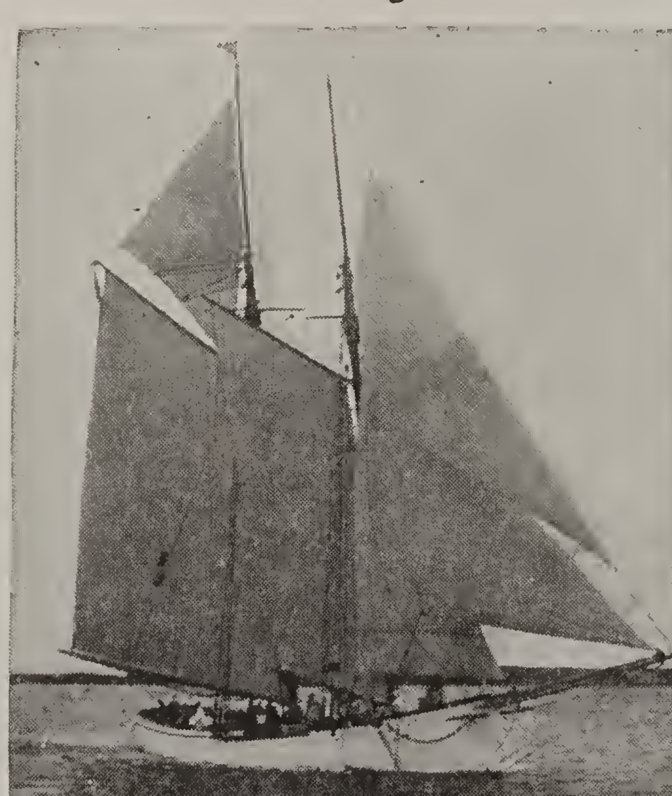
The Result of Twenty Minutes Work

The *Albatross* is a government steamer used to explore new fishing "banks" and to study the habits of salt-water fish. This trial catch is the result of twenty minutes' work in a new bank off the coast of Alaska—a good catch of fine, big cod and halibut.

are packed in salt to be dried or smoked on shore. Many fish are brought to market alive, in tanks of flowing sea water. These are caught with hooks and lines.

What would you think of five thousand hooks on one line? First there is a big cable with two hundred ropes, each a hundred feet long, strung from it. Each rope carries twenty-five

A Model Fishing Schooner



This is the Government fishing schooner *Grampus*. It was built as a model of the best type of boat for off-shore fishing.

shorter lines, with hooks on the ends and each hook is baited with a little herring or a spiral shell fish with a snail-like animal in it. When such a line is pulled up, there is a lively time on deck to capture thousands of big, flopping fish and hurry them into the tanks.

Five Thousand Hooks on One Line

Salmon fishing is done in the rivers of

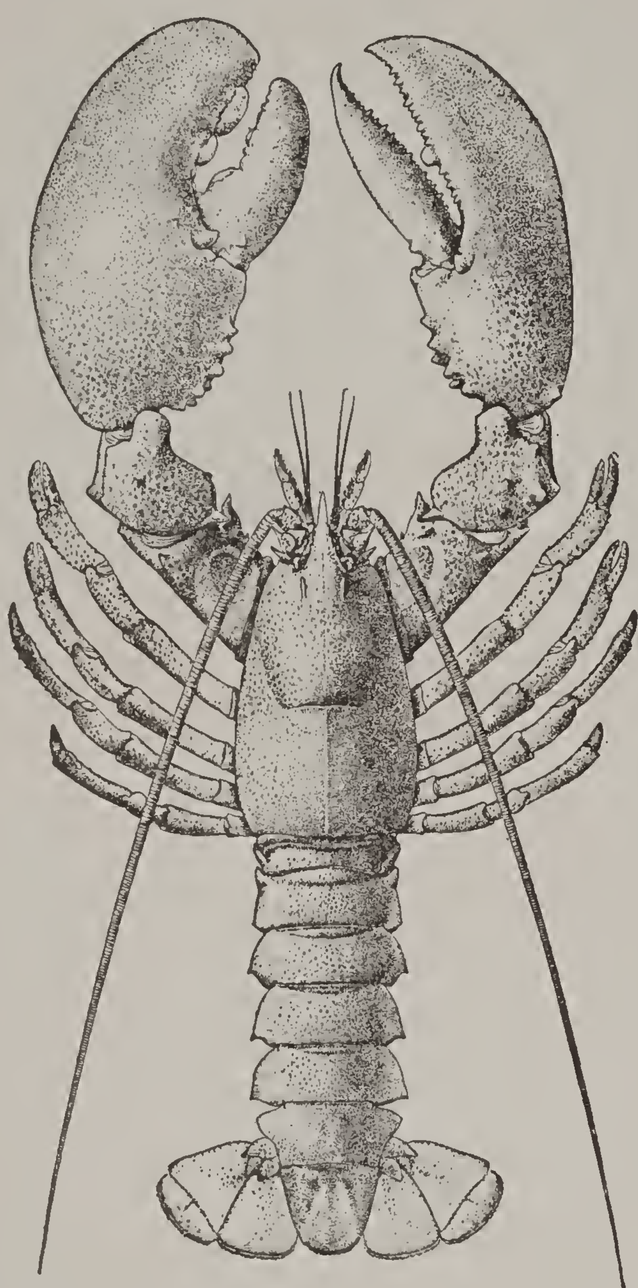
"A Helping Hand"

Here is a little French peasant girl and her fisherman papa. She is working very hard at helping to row the big boat—you can tell that by the earnest look on her face. And her papa is glad to have his little daughter there beside him to "help." Would you like to wear shoes like hers?

The Little Crab Fishers

Where is this scene? Somewhere where they wear wooden shoes, isn't it? And notice the little girl's cap. Doesn't it look like a Hollander's? Two of the boys might be twins. Which two? Do you notice where they have left their wooden shoes? What is that little group doing around the basket in the background? Why are they working in such shallow water? Where do you go to hunt for crabs? Do these children make a business of fishing or are they just doing it for fun? Notice the harness on one of the boys, and the "steering gear" which the little girl is handling. They are helping support the family and, like Andrew Carnegie when he was a boy, are no doubt proud to be "partners" with father and mother.

He Doesn't Look Good to Eat



The awkward, bright pink lobster doesn't look as though he were good to eat, but his tender pink flesh is thought to be delicious by most people. Great numbers of lobsters are caught every year on all our coasts and shipped alive to inland cities. Others are canned near the sea where they are caught.

our Pacific coast, from the Columbia, in Oregon, to the Yukon in Alaska. The salmon minnows are hatched in the cold, snow fed rivers. The pink-fleshed, silver-scaled babies find plenty to eat, even when their homes are roofed with ice. As they grow they move down the rivers, and, at last, swim out into the ocean.

The Pink Fleshed Salmon Babies

When the Fish Get Homesick

Every spring the full-grown fish become homesick and return to the places where they were born. The salmon go up the rivers to lay their eggs. They fill the bays and channels so they scarcely have room to swim. They struggle against the spring floods. They leap rapids and dams. A good many are killed on the rocks and in the shallows. Mother fish that reach the old home scoop nests in the river bottom and cover their eggs with gravel.

Fishermen know just when and where to look for the home-coming

Scallop Fishing

Scallops are little shell-fish similar to oysters. Unlike oysters they do not lie in beds attached to one spot but move by opening and shutting the two valves of their shells. Here are several hundred of them that have been brought up in the net.

salmon. They set nets across the streams; they use dip nets from boats, and nets stretched on water wheels. For the canneries the greatest number of salmon are caught in net mazes that lead into traps. The canneries are on the river banks. Chinamen cut off the heads and fins of the fish by hand, but they are split, scaled, cleaned, and cut into thick slices by machinery. Cans filled

In the Great Salmon Canneries

Fishing in Different Climes

How They Fish in Japan

© *Underwood & Underwood*

The man in the little house built on a platform of bamboo poles is a Japanese fisherman. He is lowering his net on its flexible bamboo frame and expects to draw it up again with a "good catch" in it.

with fish are put into steam boilers. When the fish is cooked, the cans are closed, varnished, labelled, and

The Birds That Help Catch Fish

© *Underwood & Underwood*

These are cormorants, the birds which the Chinese and Japanese train to go fishing. They are water birds and live on fish. By tying a string around their necks, they are kept from swallowing the fish they catch. They have pouches under their bills in which they hold the fish.

boxed. Columbia River and Alaska salmon are shipped all over the world.

Norway is Famous for Fish

© *Underwood & Underwood*

This Norwegian fisherman is lowering his net from a platform, too, but his platform is so high that he has to go up a flight of stairs to reach it.

A great deal of salmon and much of the sea and lake fish come into the market fresh. Some is smoked.

In the Congo Free State

© *Underwood & Underwood*

Here is an Upoto man in blackest Africa, making a fishing net. See the other nets hung up to dry over poles. These African natives are very fond of fish and catch a great many of them in the rivers and lakes.

Haddock, or, as the Scotch call it, "Finnan haddie," and herring are smoked too. Codfish are salted and

Fishing in the Holy Land

The Sea of Galilee was famous for its fish in the time of Christ. His disciples fished from a queer, high boat like this one. The Sea of Galilee, really a lake, was renamed "Tiberius" in honor of the Roman Emperor.

In general, the fishermen of the East, on account of the heat and because the fish are more easily caught at night, prefer the night to any other time of fishing. Before the sun has gone down, they push off their boats, each carrying a lighted torch, and in the course of a few hours, either seen out at sea, or on the rivers, has the appearance of an illuminated city.

They swing the lights out over the boats, which the fish no sooner see than they come to the place and then the fishermen cast in the hook or the spear, as circumstances may require. They have many amusing sayings about the folly of the fish being attracted by the glare of the torch.

The American Indians fished in the same way.

dried. Mackerel are kept in brine. Sardines are canned in oil, mustard, or tomato sauce. All the shell-fish are eaten both fresh and canned. There are lobsters, crabs, clams, shrimps, and oysters. We know oysters the best of all, and eat more of them than of all the other shell-fish put together.

Life and Adventure in Oyster Land

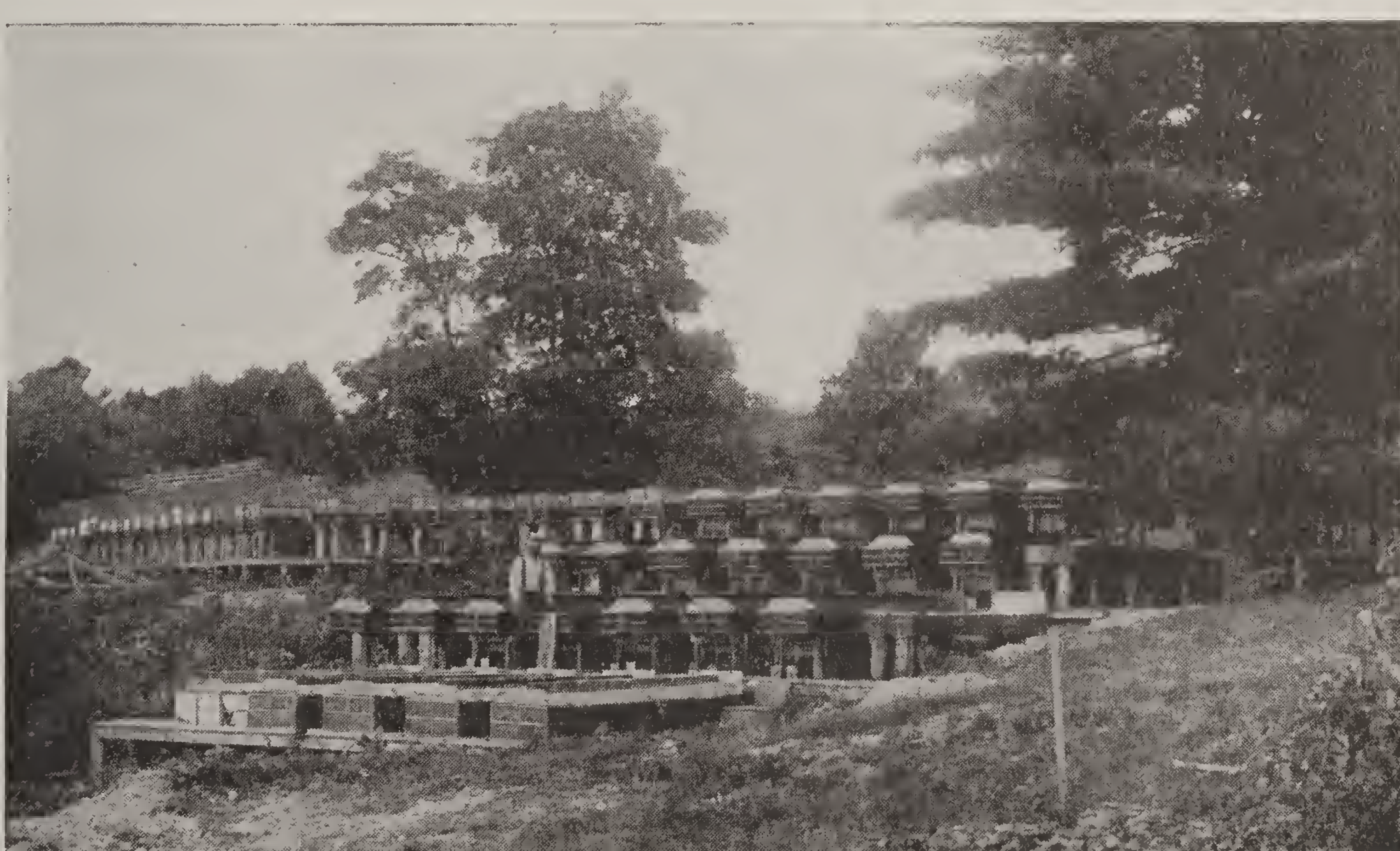
Oysters are such lie-a-beds that many sea animals have learned where to find and eat them. They like a warmer climate than cod and salmon, and quiet water that never freezes over. In our country they lie, acres of them together, in inlets,

Acres and Acres of Oysters

from Chesapeake Bay, all along the coast into the Gulf of Mexico. They lie fastened to rocks, and to each other, with their shells open, for they live on the tiniest animal life in the sea water that flows past them. Sometimes a school of star fish swim over an oyster bed and leave countless shells empty. Barnacles and sea worms eat oysters, and a snail-like fish drills a hole in

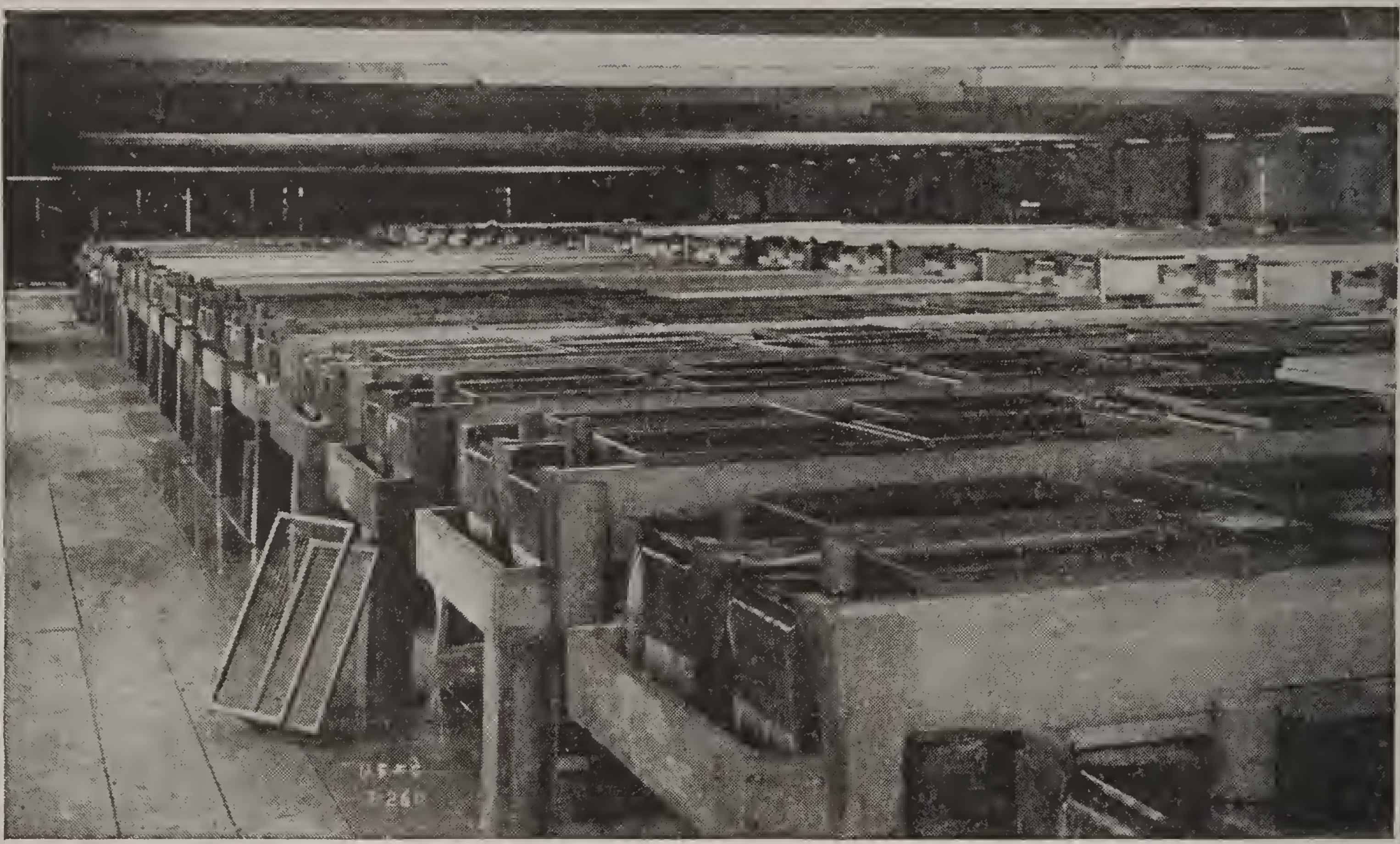
Fish-Rearing by the Government

This picture shows a model spawning pond for trout at the Wytheville, Virginia, fish-hatchery. The dam between the raceway and the pond is high enough to give the spawning fish a jump of seven inches and keep the others back. Fish, when spawning, do best when left by themselves. There are no corners in this pond for refuse to lodge in, so it is easy to keep clean.



Here you see open-air rearing troughs for the young fish. These troughs are in the Craig Brook, Maine, hatchery and contain Atlantic salmon. When young fish are first put in these troughs, they are very wild and have to be trained to take artificial food.

A Nursery for Salmon Babies



The rows of tanks contain wire "baskets" for salmon eggs, like the one resting against the post on the floor. The wooden rims of the baskets project above the top of the troughs, which allows the caretaker to handle them and still keep his hands dry. The mesh of the baskets is too fine to allow the eggs to pass through, but the fry can wriggle out. Two gallons of eggs, about thirty thousands, are poured in at a time. The water is forced upward through the mass of eggs.

These Fish Ride in a Pullman

The wooden seat covers a tank of fish being shipped to stock some lake or river. Above are Pullman berths for their attendants. Both are traveling as comfortably as possible.

a shell and sucks the oyster's soft body through. It is a wonder that any oysters are left.

Babies and Babies in Oyster Land

There wouldn't be if they did not have so many babies. One oyster lays millions of eggs, so small that a laying of eggs looks like a pan of milky water. An oyster is several days or weeks old before you can see it. Oysters are four or five years old before they are big enough to be eaten. An oyster is like a tree in one thing. It tells its age by the rings on the shell.

When the Oyster Harvest is Gathered

The great oyster harvest of our country is gathered in the winter months in Chesapeake Bay, near Baltimore. The shells are torn loose from their bed and scooped up with dredges, rakes and tongs, into boats. Some are sent to market in the shells, but most of them are "shucked" and shipped in iced cans. Lobsters and crabs are caught in bucket-like traps that are baited with meat or fish. They are caught mostly along the shores of New England. The little pink shrimps are caught in San Francisco Bay and at other places on the Pacific Coast. Shrimp fishing is done there chiefly by the Chinese.

Fishing with Otters and Water Birds

The Chinese and Japanese are the cleverest fishers! They build fish-traps, use nets and hooks, and they train otter and water birds, called cormorants, to fish for them. Besides they have fish farms and breed carp in ponds. They eat the fins of sharks and many eel-like fish.

Protection of the Sea Harvest

Wise men say that all the millions of men who make a living by fishing do not take one fish of the billions that are in the sea. Still, kinds that are constantly hunted may become scarce. Laws have had to be made to protect seals and whales, for these animals were disappearing. Oysters, corals, sponges that live in fixed beds, and

Fishing in the Early Days

This is a bone fishhook used by the Indians. It took much patient grinding to shape it so carefully and leave the little projection at the end, which catches in the fish's gills and prevents his escape.

In the lower picture two boys of Colonial days are fishing through the holes cut in the ice. They seem to be enjoying the sport from the expression on their faces.

The Fisherman's Life in Spain

©*Hespania Society of America*

Where there is no good harbor in which vessels can lie at anchor after the day's work, boats have to be drawn up high and dry on the beach where high tide cannot float them away or storms beat them to pieces. Oxen are pulling this fishing vessel up across the sand. It looks as white as snow under the sky of sunny Spain, where this picture was painted by the great Spanish artist "Sorolla." The scene is at Valencia.

lobsters that live in limited places, can be destroyed by over-fishing, just as forests can be cut down or burned. Fish die in rivers, lakes, and ponds that are poisoned by city sewage and mill waste. High dams keep salmon, shad, and other fish from going up stream to lay their eggs.

So there are fish laws in most states, as well as game laws, to keep the water pure, to prevent fishing in certain seasons, and to build ladders up dams for salmon. Wouldn't you like to see a procession of silver salmon leaping up ladders? And, also, we have fish hatcheries to restock our lakes, streams and oyster beds.

Studying the Fishes

To breed fish, men had to study. They had to find out where a certain fish lives, what it eats, when and where and how it lays its eggs, what the baby fish live on, and where it passes its years of childhood. They had to know a fish's friends and enemies and all its habits, and then experiment to see if it would take to other homes. All these things are studied in a school at Woods' Hole, on Buzzard's Bay, Massachusetts. It was built by the United States Fish Commission.

Giving the Minnows a Ride

The fish eggs are put on wire trays into flowing water and kept in motion until they hatch. The eggs and minnows are shipped in cars all over the country. Western salmon are doing well in eastern

rivers and seas, and Chesapeake oysters have taken to new homes in California. The lakes have been re-stocked with white fish and trout, the mountain streams and lakes with brook trout and other game fish.

How Uncle Sam Led the Way

It is right for us to be proud of doing brave and kind and useful things. Ours was one of the first countries in the world to protect animals and birds. It was the very first to protect fish, and to put back into our lakes and streams and bays, all the myriads of water babies that the Indians knew. In the waters of Maine woods and around the upper lakes, you can still fish as Hiawatha fished from his birch canoe, with his bone hook, and his line of cedar bark, and see the pike and sunfish:

See the yellow perch, the sahwa
Like a sunbeam in the water.
See the shawgashee, the crawfish,
Like a spider on the bottom,
On the white sand of the bottom.
See the monster, Mishe-nahma
See the sturgeon, King of Fishes.

The Three Fishers

Three fishers went sailing out into the West,
Out into the West as the sun went down;
Each thought on the woman who loved him the best,
And the children stood watching them out of the town;
For men must work, and women must weep,
And there's little to earn, and many to keep,
Though the harbor bar be moaning.

Three wives sat up in the lighthouse tower,
And they trimmed the lamps as the sun went down;
They looked at the squall, and they looked at the shower,
And the night-rack came rolling up ragged and brown.
But men must work, and women must weep,
Though storms be sudden, and waters deep,
And the harbor bar be moaning.

Three corpses lay out on the shining sands
In the morning gleam as the tide went down,
And the women are weeping and wringing their hands
For those who will never come home to the town;
For men must work, and women must weep,
And the sooner it's over, the sooner to sleep;
And good-by to the bar and its moaning.

CHARLES KINGSLEY

Weaving the Beautiful Tapestries

© *Underwood & Underwood*

We are facing the front of one of the big tapestries for which France has been famous since the middle ages. While the man before us is working on the front, others can be seen through the warp threads weaving their shuttles back and forth. Notice the little mirrors fastened to standards in front of the tapestry. By means of these mirrors the weavers whose hands you see sticking through the warp threads are able to follow the pattern as it is worked out on the right side.

·HOW TO READ A RUG·
WORK OF THE WEAVERS OF DREAMS

WHEN you were in the baby grade at school, you wove mats of colored paper. The strips of the warp sheet were joined at the top and bottom, making a square. You selected a warp sheet of color you liked best.

"What color would look prettiest with that," you thought. In your mind you could see the finished mat. That is the way with everything good and beautiful that people make. An artist imagines his picture; a musician hears his song. Mama thinks out your pretty dresses. Maybe you dreamed of your mat! You could hardly wait to make it!

Little Weavers in School

You threaded strips of the other color into the flat, weaving needle. Over and under the warp you wove. When all the mats were pasted on the wall you saw that some were prettier than yours. That taught you a good deal about colors and patterns.

Next you made a loom of a slate frame. The warp was of cotton cords stretched, close together, from tacks at the top and bottom of the loom. Across these you wove woolen threads. With a comb you pushed the woof threads up until they hid the warp. You tied the warp threads at the ends, to keep the woof from raveling. You had a strong, soft rug to put by dolly's bed.

How Big People Began to Weave

In many parts of the world people began to weave cloth and rugs in this way. First they wove mattings of rushes and grasses, then homespun blankets of animal wool, silk, cotton and flax. The best weavers everywhere were the shepherd tribes. They could not buy anything to work with. They had to shear the sheep, goats and camels, comb and spin the wool into yarn with rude, home made cards and spindles, and find dyes in plants. Then they had to make up their patterns from the beautiful forms and colors about them. Let's "play like" we—we girls—

American Hand-Woven Rugs

Navajo blankets are used for rugs. The soft texture, intricate designs and blended colors of Oriental rugs tell their own story of long years of experience in weaving and artistic expression, by a people whose civilization is very old. In the same way, the designs and crude colors of Navajo blankets are typical of the Indians. The Indians are a people just rising out of barbarism, but their blankets are artistic and beautiful. This is an old Navajo Indian Woman weaving one of the blankets for which her people are famous.

Women the World's First Weavers

for women always did the weaving, lived far away and long ago. We were Navajo Indian girls in America; or Persian, Turkish, East Indian or Chinese girls in Asia. We lived in tents in a valley, on a plain, on a mountain slope, or on a palm-shaded oasis in the desert. Every day or so the tents were moved. The tribes followed the flocks and herds to fresh pastures.

The men and boys and dogs were out with the flocks. *They* had adventures. The women and girls staid with the tents. They cooked food, dressed skins, made clothing and tent covers. They wove baskets and made pottery. Often they plaited in and painted colored designs. When they began to weave cloth their first loom beams were the limbs of trees. From stout, low branches warp threads were hung and pegged to the earth, or weighted at the bottom. The next step came when rude frames, that could be taken to pieces and carried about, were made.

Colors from Many Sources

One by one the weavers found colors. The Navajos made a red dye of the coch-i-neal, a seed-like insect that lived on the cactus plant. They wove scarlet stripes and figures on their gray and black blankets. In Asia there was a red insect, too, and a red dye was made

of sheep's blood, and from the madder plant. The yellows came from the Persian berry, larkspur, saffron and turmeric. The husks of walnut gave a brown dye.

You know that you need only yellow, red and blue in your paint box, although it is nice to have tubes of black and white. By mixing the three colors in different ways, you can make many tints of all colors. The weavers learned to dye light and dark and to mix their dyes. But by the cross-weaving they could make only stripes and simple figures. In Asia the weavers began to pick up a few threads of the warp at a time with a wooden shuttle needle. They wrapped the woof around the threads. Then they picked up the next few. This made the khilims, or needle-woven blankets. Many colors were used, in blocked and figured patterns. But the weavers were not satisfied.

Such beautiful things were all around them—the blue sky, the green trees and grass, the flaming sunset, the rainbow, flowers, birds and stars. In the market cities where the wool was sold, the Persian shepherds saw walled flower gardens, topped with palms, and trailing vines. In the Turkish cities were churches with gilded domes, floors in blocks of colored marbles, lanterns, jewels, enamels and gold embroideries on silk. The Chinese shepherds saw temples, painted pottery, lacquer ware and needle-worked silk. Everything in Chinese cities was decorated with dragons, bats, birds, flowers and clouds.

A Turkish Rug Factory

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Most of the workers in this Constantinople rug factory are girls. The overseer (probably he is the owner, too) sits by the window and watches the work. There are no machines, you see. for all the costly, beautiful Oriental rugs are made entirely by hand.

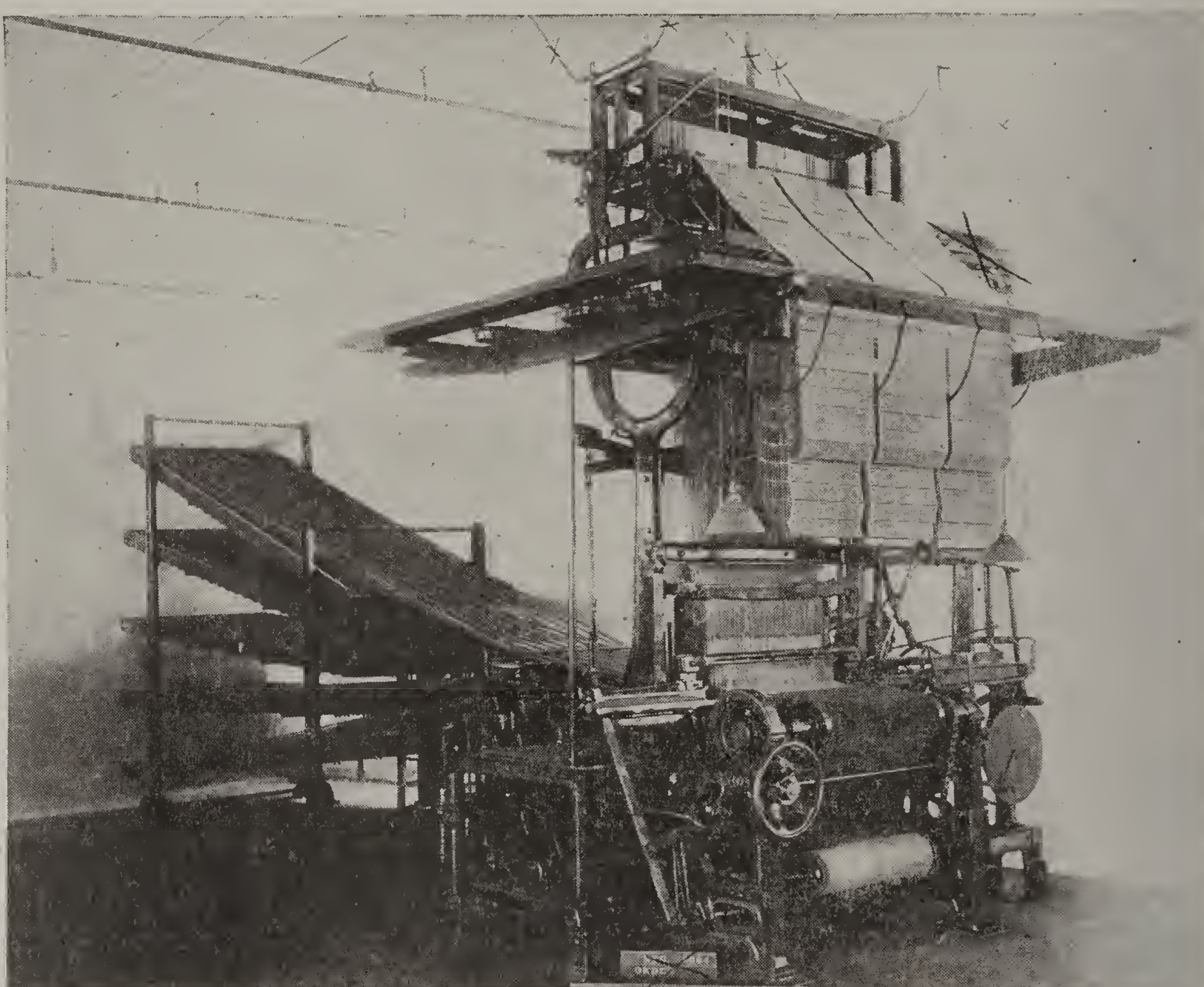
Weaving the Dreams Into the Rug

The women went back to their lonely tents to dream. They had no books, no pictures, no jewels, temples or gardens. To work out their dreams of beauty they had only the loom, the spindle, the wooden cards and combs, shears and the dye pot. But with these they made the first, the best, the most beautiful carpets in the world.

Some one in your town has an Oriental rug. Oriental means eastern. For three thousand years, or more, Oriental rugs have been made in villages and tents of far eastern countries. Look carefully at one. The surface is a wool velvet, very soft and thick. The pattern is like

painting, embroidery, or jewel work. The same pattern, but not the velvet pile, is on the back. If you part the pile you will find that each stitch is tied on the warp. A strand of yarn is wrapped around two warp threads, twice. The ends are drawn knots to the square inch are often seen. Some have nearly one thousand knots. A rapid weaver can tie three knots in a minute. Five hours to weave one square inch! There are some rugs that have taken twenty years or more to weave!

A Brussels and Wilton Carpet Loom



This is a Jacquard loom for weaving Brussels and Wilton carpets—machine-made rugs of Oriental pattern. There is another picture of a Jacquard loom in the Story of Silk. The perforated cards that control the design hang at the top of the machine.

up between the warps and clipped.

How a Rug is Made

In making a rug a row of knots is tied on. Then the warp threads are crossed, and a woof thread is shot across the loom. With a comb the weaver pushes the knots up solid. When several rows are knotted they are clipped even with shears.

On the back of a rug you can count the knots in a square inch. Rugs with one hundred and fifty

Stories the Rugs Tell

Now people who make a study of rugs can tell where each one came from, although no two are ever just alike. Anyone can remember this much. Persian rugs have flower, even garden patterns with wall borders. Rugs of the Caucasus mountain region are in squares, triangles, hexagons, octagons, like tile and jewel work. Turkish and Chinese rugs combine the flower and blocked

Design Artists at Work

© Underwood & Underwood

The little Turkish boy in the picture is tired of play and has come in to rest on the pile of soft rugs and to watch his father and big brother at work. They are touching up and deepening the colors in the design of a rug.

patterns of the other two.

To the people who made and first used them, the rugs were the furniture of the tent. They were beds, seats, cushions, door hangings, saddle bags, pictures on the wall, canopies over the chief, trappings for horses and elephants and camels, gifts to lay on church altars, prayer rugs. Some of them were made of silk. The rugs were made and used for centuries, before western people discovered and began to buy them.

Weaving a Cashmere Shawl

© Underwood & Underwood

The beautiful designs and texture of Cashmere shawls have long been famous. They are made by poor workmen, like these, on the simplest and most primitive of looms.

How Oriental Rugs Got a Temple

The people of Europe had learned to weave many kinds of cloth, but on their floors they used skins and rush mats until they began to copy the Oriental rug. In France some wonderful tapestries were made by hand, but they were too beautiful and costly to be used for anything but wall hanging. Imitation Turkish and Persian carpets were first made by machinery in the factories of Wilton and Axminster, England. There was a foundation webbing of linen or jute. Warp yarns of worsted were carried along on top and woven into the back. There had to be as many layers of worsted warp as there were colors in the pattern. Each color was picked up when wanted, by little hooks. This was done in the Jacquard loom, that weaves the figures of silk and linen damask. In brussels carpet the stitches were woven over wires. When the wires were pulled out, rows of loops were left in ribs all over the surface.

Imitating the Oriental Rugs

If a velvet surface was wanted the wires were flat, or grooved, and the loops were cut, making a pile. For tapestry brussels the warp layer was printed before weaving. You can tell a "body" from a tapestry brussels by turning it over. A "body" brussels shows the many colored threads of the pattern in straight lines on the back. It is heavier and wears much better, with so many layers of worsted embedded in the back. The colors are better, too, as they are dyed in the yarn, and not printed.

How a Smyrna Rug is Woven

We have found out another way of weaving the velvet pile carpet. This is in the Smyrna rug. The pile is first woven like a brush on a cord. Then the cords are woven into a warp. Both sides of a Smyrna rug are alike. The ingrain carpet can

be turned, too. We invented that. Only two or three colors can be used in the two or three-ply ingrain. A cross-woven web is made by each color. The webs are interlaced, to make the pattern. In a brown and tan ingrain, a figure that is brown on one side of the carpet is tan on the other.

Choosing Weaves and Patterns

The nearer our carpets come to copying the old Oriental rugs, in patterns and colors and texture, the better they are. You can ask for an Axminster or Wilton carpet in the Bokhara pattern. It is a dark crimson, with a small octagon design in many colors. Favorite Persian designs have a center of repeated palm leaves, or a floral medallion and wide border, on a plain field. Many of the Turkish patterns have a point at one end of the central pattern. That is the prayer rug.

All the kinds of carpets that can be woven on machine looms are made in the United States, in over four hundred factories. We make body and tapestry brussels, English Wiltons and Axminsters, French moquettes, Saxony and Scotch carpets, "Smyrna" chenille rugs, and "art" rugs in ingrain weaves. The best of our carpets are made of good wools, colored with vegetable dyes. They wear for years. Their colors become softer but do not fade.

American Rugs and Carpets

People who have traveled over the world, seen everything and learned what is good taste in furnishings say that if you cannot afford a real Oriental carpet, or the best machine-made copy of one, you should use the simplest art rugs in ingrain, or even rag rugs, woven or braided by hand. You see, we put ourselves into anything we make. We put honest materials and work into it; our own thought of what is good and beautiful, and our love for the people who will use it.

Good Taste In Rugs

The Eastern rug weavers put all these things and many more into the wonderful webs they wove on their rude looms. You can find history and religion, poetry and music, old fairy and folk tales, and all the arts and crafts and dreams of the East, in the Oriental rug.

One Way in Which Rugs Are Used

In hot Eastern countries the roof is like our porch—it is the place where the family goes at evening to cool off and rest. Here is an Algierian mother and her two little girls. They have had their coffee on the rug spread out on the roof. While the girls play on the rug the mother sits on the parapet and looks out over the city.

Curious Roots of a Rubber Tree in Ceylon

© *Underwood & Underwood*

This picture is a very striking example of one of the monstrous native rubber trees to be found in Ceylon; and—it is very curious and you would hardly believe it—but this is the very same species of tree that we have in pots and houses as ornamental plants! It's a good thing rubber trees don't grow as fast as the bean stalk in "Jack, the Giant Killer," isn't it? Otherwise we might wake up some morning and find our little rubber plant "all over the place," as our English friends say.

HOME OF THE RUBBER SANTA CLAUS AND THE GIFTS ON HIS WONDERFUL TREE

THERE is one tree that, if hung with its own gifts to us, would make a Christmas tree.

A Rubber Christmas

There would be presents for every member of the family. For the baby, new nipples for his milk bottle, a ring to cut his pearly teeth on, a soft dolly and a toy dog that he could put into his mouth, cushiony tires for his go-cart and a big, round, moon-y balloon to surprise his dewy blue eyes.

And Still the Rubber Gifts Come

Johnny could have a bouncy ball, a raincoat, overshoes or wading boots, and an eraser to rub out his mistakes in arithmetic. For sister, there would be pretty combs and brushes for the toilet table, an air pillow for the porch hammock, and silk elastic stocking supporters. Mama could be fitted out with hot water bottles and tubing, a rubber sheet for a sick bed, mats for careless children to wipe their feet on, bath sponges, valves and washers for

House Full of Rubber Things!

her sewing machine, rollers for the clothes wringer, and gloves for such dirty work as blacking stoves. There could be a new hose for watering the lawn and putting out fires, and new tires for the bicycle and automobile. The tree could be trimmed with strings of corks for medicine bottles, buttons and fountain pen holders. There would still be plenty of rubber left over to cover electric wires, and to supply dentists

The Rubber World and Rubber Things

On brother John's football the artist has drawn a map of the rubber regions of the world. You know what part of the football is rubber and why it is given a place in this picture of rubber things. Around it is one of the tires of father's automobile and there are two red balloons staring at you like two big eyes. The telephone is of the kind used in big offices for talking from one part to another. Here also are a rubber shoe, a rubber heel, baby's rattle and rubber dog—I'll warrant you it squeaks and opens that little mouth—a rubber ball, a hose supporter, a rubber glove, a hot water bottle, and the rubber disc that will sing for you or play any kind of instrumental music and make a speech—whatever it has been "taught" to do.

with the silky brown blankets they stretch across the mouth when they fill teeth.

Then There's the Phone and the Phonograph

Anything more?

If anything is missing, such as a black rubber talking machine record, use the rubber telephone to order another.

It is such a handsome tree that makes us all these gifts! It is sixty feet in height, when full grown, and as straight as an elm, branching high in arching plumes. But the bark is a silvery gray, between that of the birch and the beech. From the ends of the twigs the long, shining, rubbery leaves droop in clusters of three. So thickly do other trees grow all about it, in the tropical forest, that you could scarcely see the sprays of small white flowers that open in August. But in the winter you could hear the nut-cases explode like—like Christmas crackers! The rubber tree shoots its seeds many yards.

Handsome Mr. Rubber T. Santa is 60 Feet Tall!

Where People Milk the Trees

If you should ever visit the great Amazon valley, in South America, you could go into the woods and watch the native Indians and negroes milk the trees. Many trees, vines and small plants have a thick, milky sap. Snap off a rubbery dandelion stem, a head of lettuce, or a stalk of milk-weed, and see what oozes out. The bark of the rubber tree makes so much of this thick, creamy juice that it is milked as regularly as a cow. This juice can be hardened into rubber as cow's milk can be churned into

A Rubber that Grows in Your Garden

butter and pressed into cheese.

How the Aztecs Used Rubber

We did not know how to do this until about seventy years ago. That is queer, for Columbus found the Indians of Haiti playing with rubber balls. And in Mexico the Aztecs showed the Spanish explorers how to paint cotton cloth with rubber to make rain coats. The trouble was that the balls decayed and smelled as bad as spoiled fish, and in the hot sun the raincoats became as sticky as molasses. It was three hundred years before an American inventor discovered how to harden, roll and mould rubber. The whole process of collecting the rubber milk, curing, shipping and making it into so many different things is very curious and interesting. Would you like to see all these things done?

Three Hundred Years of Experiments

The Steaming Land of Rubber

First you would have to take a long journey to some very hot, wet country. Rubber forests are found in the valley of the Congo, in Africa, in the East Indies, Mexico and Central America. But the finest are in the valley of the Amazon and its great tributaries. Exactly on the equator, more than one hundred inches of rain falls there in a year, making it a steaming, flooded jungle.

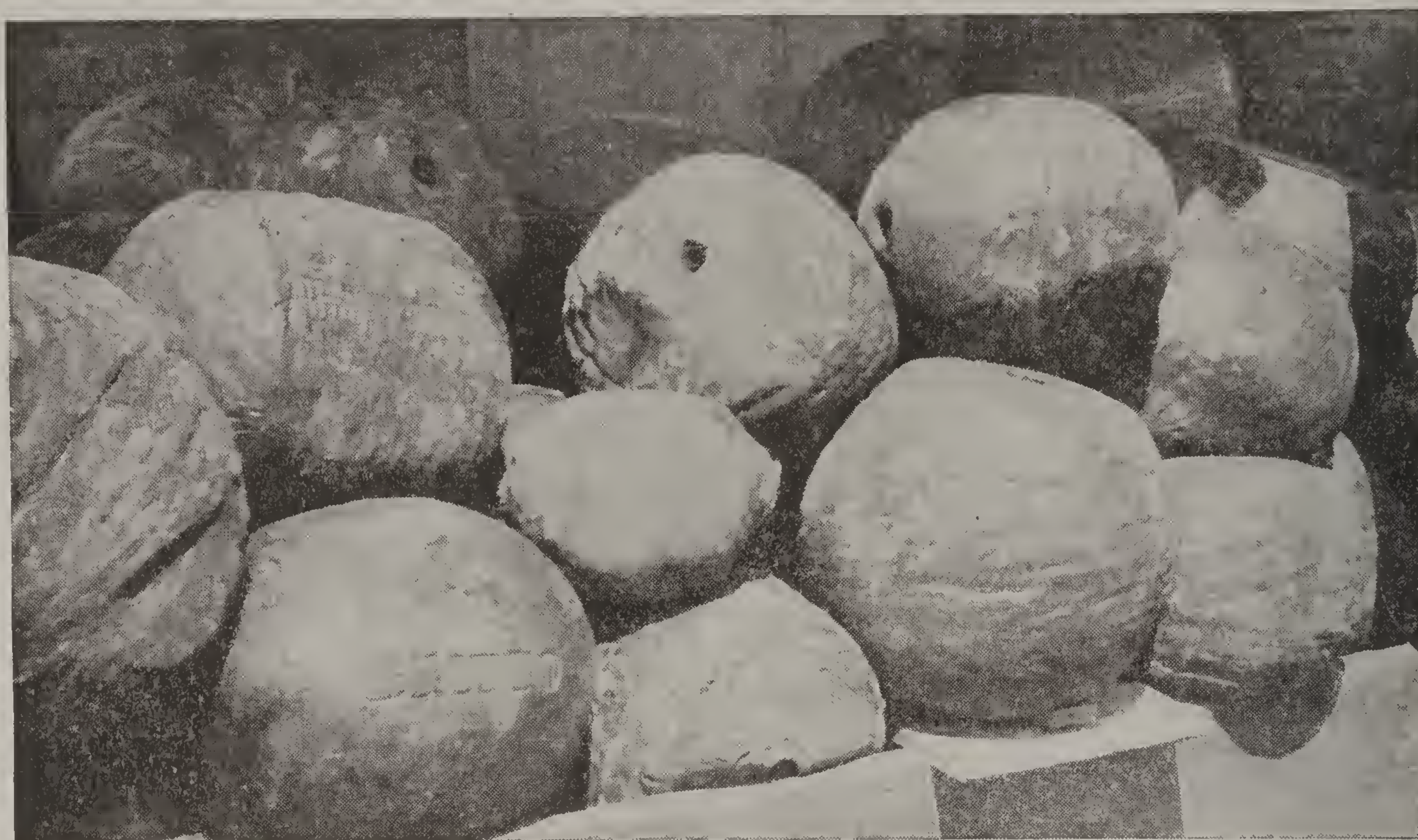
Not a Pleasant Place to Live

An American rubber plantation in Mexico, showing young plants.

Your first stopping place, from New York, would be the city of Para, at the mouth of this wide river. Sixty years ago no town was there, and none would be there today but for the cargoes of rubber that come down to be loaded on the ships of many nations anchored in the harbor. From these vessels are unloaded machinery, tobacco, canned goods, meats, lamp oil, clothing, and every common comfort of life, for the rubber camps far up the untamed river. When they steam away they carry rubber in big, greasy, football looking lumps, Brazil nuts and cocoanuts, cocoa beans for making chocolate, and—guess!—cages of chattering monkeys, squalling green and red parrots and rare tropical plants—orchids, palms and ferns.

Supplies for the Rubber Camps

Rubber Biscuits



© Underwood & Underwood

For the trip up the river you would board a modern steamer with chuggy engines and electric lights. But for three days you would see no town—now and then just a few palm-thatched huts about a rotting wharf. On either bank you would see a wall of trees with their feet in the water. Great vines lace them, and brilliant blossoms, butterflies and long-tailed jewels of birds twinkle and flash on that emerald screen. In drenching rains, glaring suns and steaming vapors you would make your way to Manaos. This small, rich, busy city is the St. Louis of the Amazon. Get your map and see how many streams flow into the Amazon near it. From Manaos, in small cargo and supply boats, you could go hundreds of miles up the Rio Negro, the Madeira, or a half dozen other rivers, and to as many countries. Rubber forests lie along every one of them. On any bank you would find little camps of Negroes and Indians, with a white manager, living in one or traveling from camp to camp.

Beautiful Scenery, But Oh How Hot!

Rubber Plant Showing Leaves and Berries

It is in our winter, which is the dry (or less wet) season on the Amazon,

that the rubber trees are milked. With tiny hatchets a few inches wide, slanting gashes are made in the bark. The gashes are made in the herring-bone pattern that mama uses as a fancy sewing stitch. A few are made every day. As high as a man can reach on the trunk, the tree is girdled with rows of these gashes every season. The wounds are made only in the bark, and soon heal. An ignorant or careless person, by cutting into the wood, kills the tree. The rubber milk is not a sap, but a gummy fluid made by the bark. Below fresh gashes, cups are fastened to catch the pearly rubber drops that trickle down. A big tree will "give" six ounces of milk a day, about enough to fill a bottle for a hungry baby. Then the last drops dry on the cut, as blood dries on a scratch. In the evening the milk is collected in pails and brought into camp. It is snow-white, and has a smell of ammonia.

Native Woman Tapping a Rubber Tree, Ceylon

How Rubber Milk is Like Cow's Milk

Rubber milk is like dairy milk in two ways. A thick cream rises to the top above a watery fluid; and it spoils quickly. It must be taken care of at once—be dried and smoke-cured. Each workman with a pail of rubber juice, builds a very smoky fire of palm leaves and nuts, under a low clay chimney. He dips a wooden paddle into the top cream and holds it in the smoke. When this has hardened, the paddle is dipped again. A ball of greasy, brown rubber that weighs several pounds is made. This is cut open and the paddle pulled out. The pure, white rubber juice has been turned to a dirty yellow, smoke-streaked, cheesy-looking substance. It is crude rubber—useless in this form.

Hardening the Rubber

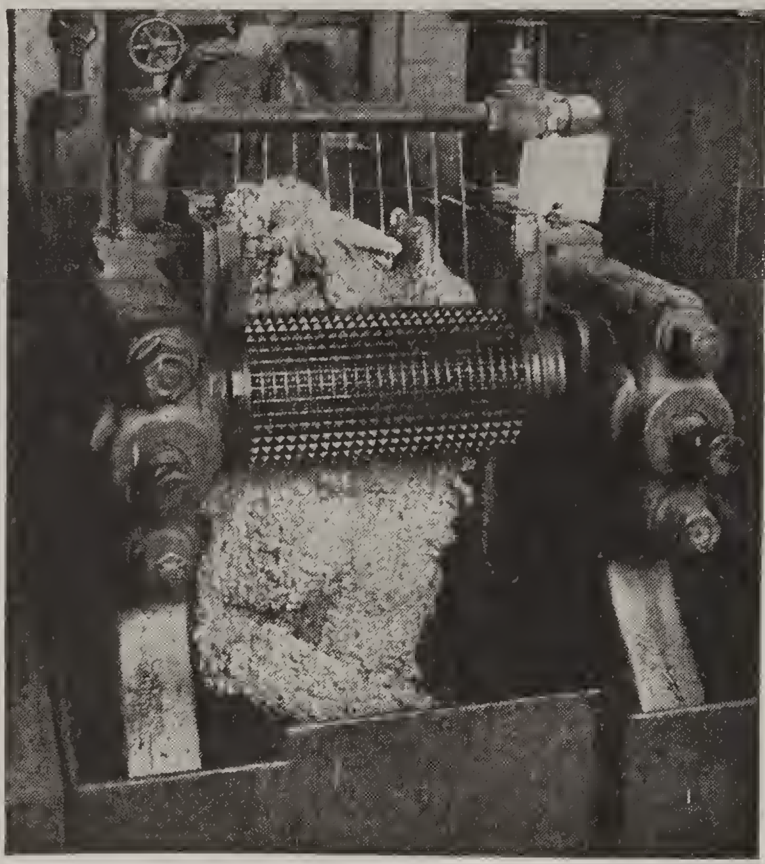
You could play football with a lump of crude rubber or rub out pencil marks, but you could not do much else with it. Nearly a hundred years ago a clever Scotchman melted rubber in naphtha and varnished cloth with it. That gave us our first raincoats called mackintoshes from the name of the Scotchman. Twenty years later Charles Goodyear, an American, hardened, or vulcanized rubber by melting it with powdered sulphur. A rubber comb as hard as horn, has a great deal of sulphur in it. Soft rubbers have less sulphur but they have other minerals and powders to give them

The Sulphur in Your Rubber Comb

softness, smoothness and color.

When crude rubber comes to the factory, it is put to soak in hot water to soften and clean it. It is full of sand, leaves, bark scales, twigs, rubber-tree cockroaches, and is greasy with palm-nut smoke. When the lumps are as soft as putty they are chopped fine and fed into a washing machine. Heavy, hot steel rollers soften and flatten the mass that runs together like stretchy taffy, while a stream of hot water washes out the dirt. The sticky bits are kneaded and rolled, and come out in one thick, rough sheet like a furry bath mat.

Washing and Grinding the Crude Rubber



After the gum has soaked in hot water for about two weeks it is taken to the grinding machine, where it is passed through the grinding rolls. These grinding rolls, one of which is shown, chew up the rubber, and cold water from the pipe washes the dirt out of it.

This is dried for several weeks. It is pale in color and you can almost see through it. It must then be filled, or saturated, with sulphur.

Then it is Mixed With Sulphur

In some factories the rubber is put into a bath of melted sulphur to soak. But in most cases the rubber sheets are warmed and softened on hot rollers, and the sulphur flour and other minerals are sprinkled on and gradually kneaded in. But this isn't all. The sulphur must be melted and baked in.

Mr. Goodyear found that out by accident. In one of his experiments he was mixing warm rubber and powdered sulphur in a kettle on the kitchen stove, when he accidentally slopped a big spoonful of it onto a red hot lid. It made a dreadful smell, but it did not catch fire. When he lifted it, in a flat cake, it hardened. He nailed that on a wall out of doors. Neither sun nor frost affected it, and it was smooth, dense, elastic and water tight. He just stumbled on a great discovery. Today, rubber factories are fitted with washing and mixing rolls, rolls for rubber-coating cloth, moulds and die-stamps and vulcanizing ovens.

Here's Our Cooky Cutter Again

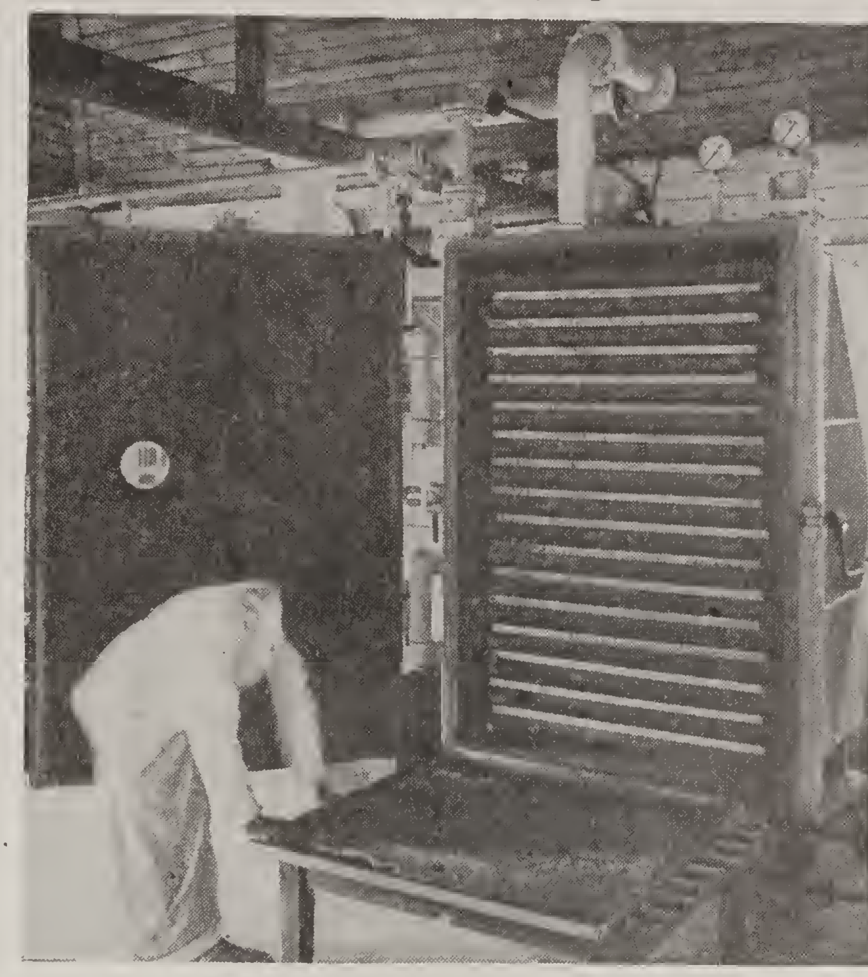
Corks, washers, fruit-jar rings, water plugs for bath basins and tubs, and many small articles are cut from sheet rubber of different thicknesses, with die stamps, and are then vulcanized in steam-heated cylinder ovens.

How Rubber Articles Are Made

Overshoes are made of a number of pieces of rubber-coated cloth, shaped on lasts, and cemented with rubber solution. Hot water bottles and hollow rubber balls and toys are made in the same way. Solid rubber tubing is made by forcing very soft rubber through a kind of sausage machine. Rubber thread, for weaving into elastic ribbon, and for making snap bands, is cut from many thin sheets of rubber

clamped into a solid block. Solid rubber tires, for bicycles and baby buggies, are sometimes made in the sausage machine and sometimes are built up in moulds. The baby's rubber nipple is made by dipping a glass mould into a rubber naphtha solution. Layer after layer is formed by drying until the nipple is thick enough.

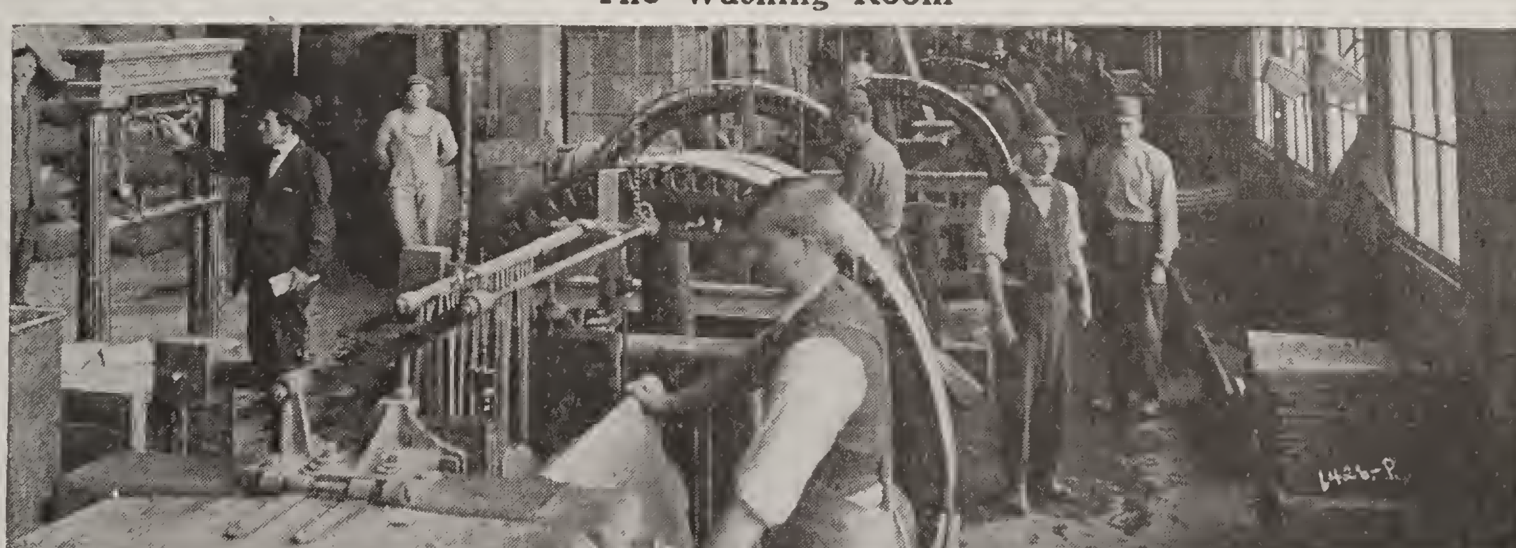
Vacuum Dryer Used in Drying Crude Rubber



© *Underwood & Underwood*

Large fire hose are built up of layers of canvas, embedded and coated with rubber. Some are joined in a straight seam, some wrapped spirally; some are made on canvas tubes, coated inside and out, by that sausage machine. Pneu-mat'-ic, or air-filled automobile tires are built of very hard rubber on canvas, around a core. The tube is fitted into a mould, and the rim and tread filled out with solid rubber. It is vulcanized in great heat under pressure.

The Washing Room



The foreign substances are here being taken out of the rubber by washing with water. The rubber comes out of this process in sheet form, free from dirt and ready for the Calender Room.

Queer Way of Making Rubber Balls

One of the most difficult things to make is a hollow rubber ball or toy, filled with air. For a ball the pieces are cut from rubber-coated cloth, in sections, like the peeling of a quartered orange. Inside of one section is pasted a lump of untreated rubber, with no sulphur in it, and the place marked on the outside. Then the sections are cemented together, with a tiny pinch of carbonate of ammonia shut inside. The four-sided, seamy ball is put into a round, iron mould and baked. As soon as it gets hot, puff! that ammonia turns to vapor and

Heavy Men for Heavy Work

This picture shows a group of sturdy workmen in the Curing Room. They need all those muscles in the Curing Room because the molds are very heavy.

tries to get out. It pushes the sides of the ball against the mould, so it is stretched and baked into a perfect globe. When the ball comes out it is very soft. A hollow needle is pushed through the lump of untreated rubber, and air is forced into the ball to swell it out, tight and smooth. When the needle is removed the rubber closes like wax. The compressed air sealed up in the ball is what makes it bounce.

Making the Air a Prisoner

All rubber is air tight. Because it stretches a great deal you can force a lot of air into a toy balloon, a bicycle or automobile tire. Then, if the tiniest hole is punctured, it pops like a pistol. Perhaps those rubber-tree seed-cases are sealed up, full of air. When dry they split and go off with an explosion like a fire cracker.

Story of a Rubber Tire

Speaking of rubber tires, wouldn't you like to know how they "grow" on the wheels of Father's car? Well, we will tell you, now, in the best of all ways of telling things—by pictures. These big, stout men, looking at us here, are only just a part of this story. Their work comes in—as you will see—after the tires have been shaped and must be lifted and run into the heaters where they are what is called "vulcanized." This process makes them more elastic and durable. Combs, fountain pens and other hard, black rubber things, have substances mixed in the rubber before vulcanizing so that, instead of being elastic, they are very hard. You can do all kinds of things with rubber if you know how.

The Calender Room

The rubber is here rolled out into sheets and passed on to different departments requiring that kind of stock. Notice the big rolling mills and the sheets being wound on spools as they come out.

The Curing Room

This is the curing room in which you see the pneumatic tires ready to be placed in the heaters to be cured.

Rolling the Rubber into Sheets

The rubber is now passed through the sheeting rolls. As the rubber sheet passes through the rolls, it is laid on cotton cloth in which it is wound. This cloth prevents it from sticking together and also keeps it clean. It is then wound on a roll, so that it can be easily unrolled when cutting it up into strips for rolling on the arbors.

The Pneumatic Tire Room

Here we see the pneumatic tires being built by machinery. More tires are now made by machines than by hand.

The Finishing Room

This is the room in which the tires are finished; that is, brought up to the point where they are ready to be cured.

The Curing Room

Here is the Curing Room where the tires are being placed in molds. They are then run into the heating ovens where they are left a sufficient length of time to cure or vulcanize the rubber.

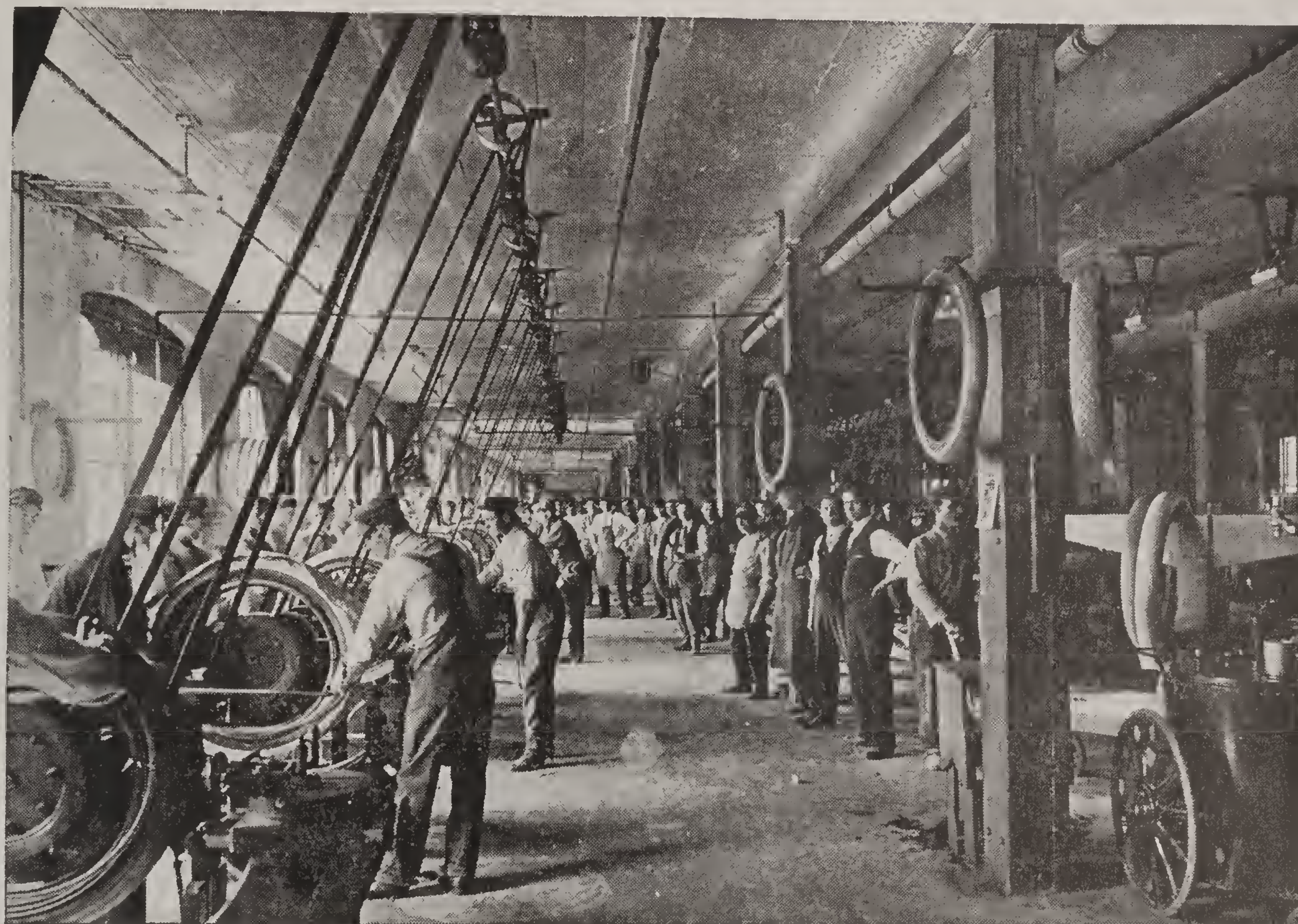
The Tread Laying Room

This is the room where the tread rubber or that rubber that comes in contact with the surface of the streets, is cut out.

Where the Treads Are Cured

The tread, like every other part of the tire, must be cured. Here is where the tread is cured. To the left can be seen the large heaters in which the tires are placed.

Putting on the Treads



This shows how the tread rubber is put on the tire. The treads are cut into lengths equal to the circumference of the tire and these are made a part of the tire in this room.

Making the Inner Tubes

Here are women workers making inner tubes by hand. Much of this work is now being done by machine, but owing to the wonderful growth of the automobile industry, it is difficult to obtain machine equipment sufficient for factory needs and it is frequently necessary to help out with hand labor.

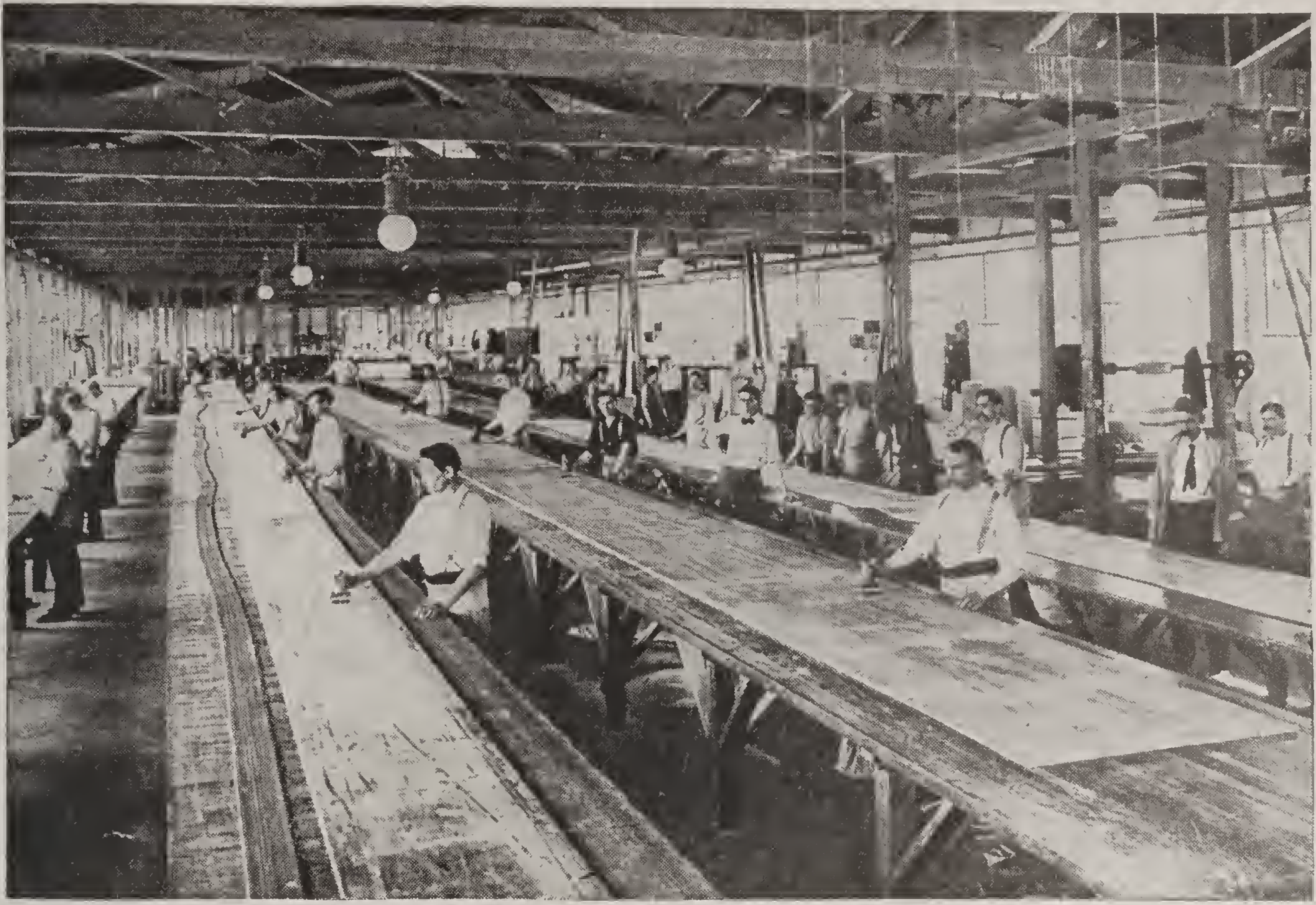
Where Accessories Are Made

In this room are manufactured what are known as automobile accessories, such as gums, tapes, and cements.

Examining and Inflating Room

Here is where the tires are finally examined for defects. The workman in front has just pumped up a tire and is examining it.

Making Rubber Belts

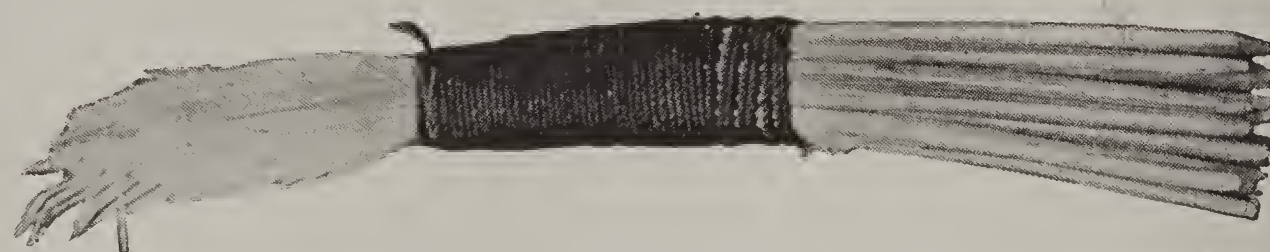


For certain service, rubber belts are superior to leather. Here the cotton duck, impregnated with rubber, is folded, covered and made into belts varying from two inches to six feet in width.

Vulcanizing the Belts

Here the belts are being vulcanized in hydraulic presses consisting of an upper and lower steam chamber. These chambers close under a pressure of 2,500 pounds to the square inch. As the belting comes out of the press, you will notice, it is rolled on spools.

How Birds Helped Us Write



If you should ever visit the Essex Hall Museum in Salem, Mass., you would see, among the many interesting relics of our forefathers preserved there, this bundle of quills. Notice that the quills have not been sharpened. You know how much time it takes to keep your pencils sharpened in school. Now, suppose you had to keep sharpening your pen over and over in the same way, with a "pen knife," as they used to do in the old school days.

LINCOLN liked to study the dictionary. In the commonest words there he found history and romance. In French, a pen is called *plume;* in German, *feder.* Pen is from the Latin *penna,* feather.

Birds of "The Feather"

As a boy, Lincoln made his own pens from the wing-feathers, or quills of wild turkeys and geese. All sorts of things have been used to write with—bodkins of bone, ivory and bronze; bamboo, stiff grasses, reeds, quills of eagles and swan, thin horn and tortoise shell. As all these pens lost their points very fast, about a hundred years ago the "nibs" began to be plated with gold, and tipped with diamonds and rubies. The first good steel pens were made about 1840. It took a half century of invention to work out the idea of making a steel pen as flexible as a quill by splitting the point, and making a round hole at the shoulder. When your grandpapa was a boy most children used the copper colored bronze pens of Joseph Gillot. One—just one—of the beautiful shining steel pens that school boards often furnish free to pupils, once cost five shillings each. To make a pen so perfect and so cheap is one of the wonders of our day.

Nearly Fifty Things Done to a Pen

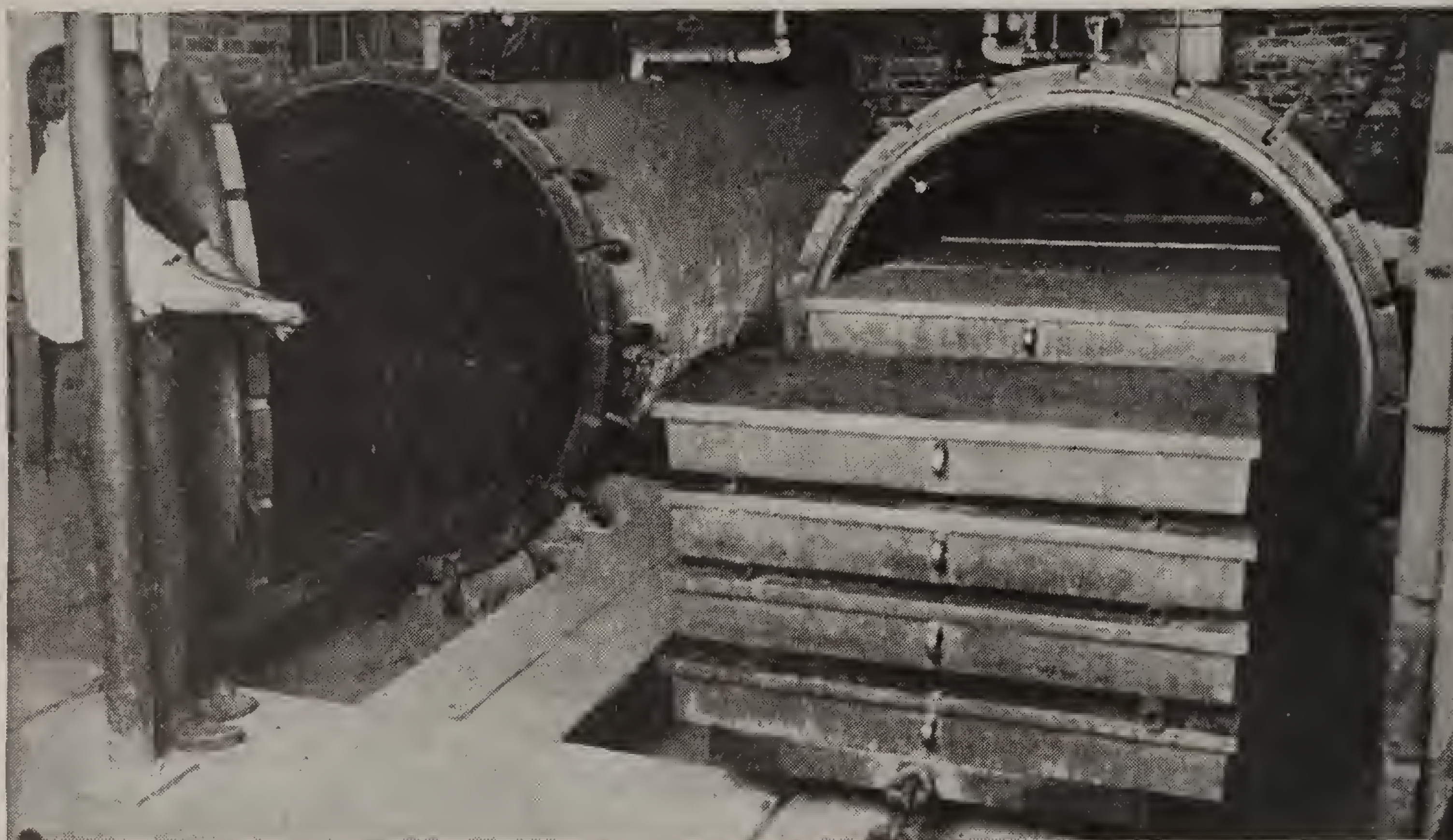
The finest sheet steel made of Swedish iron is used, and the little writing implement goes through nearly fifty processes before it is finished. It is cut from the sheet in strips, rolled, heated, pickled in acid, clipped, pointed, stamped, split or "nibbed," heated in oil, polished and ground. In Camden, Meriden and Philadelphia we make two hundred and fifty million pens a year, and then buy more from England and Germany. No other country makes as many or as good gold and "fountain" pens as we do. Gold pens are now tipped with a hard metal — iridium. The fountain pen, with the self-filling barrel and even flow of today, was made only after a century of experimenting.

How Fountain Pens are Made

Here you see the rubber "Biscuit," brick of gold and Bottle of Iridium used for hardening the pen points. Iridium comes from the Ural mountains in Asiatic Russia and costs about $1,500 per pound.

This workman is covering the barrels of fountain pens with soap stone to prevent their sticking together when put into the oven shown in the next picture.

Baking and Polishing

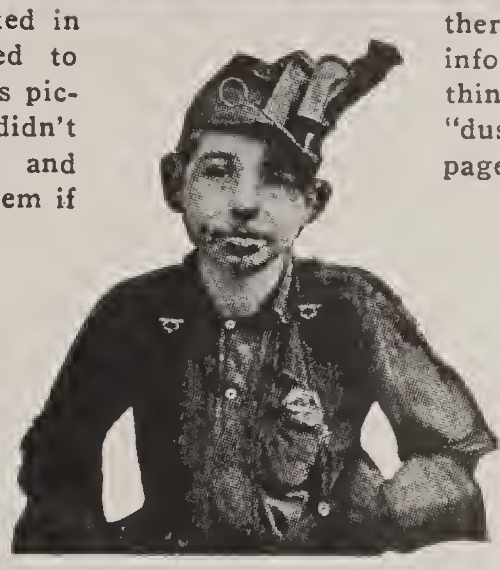


In the upper picture the pen barrels are going into the oven. In the two lower they are being polished after baking. The rubber of which pen barrels are made is mixed with sulphur before baking. This is called "vulcanizing" and makes the rubber hard and black. The barrels are polished, first with steel shavings and next on what is called the "buffing wheel." The polishing, as you see, is done very much as you polish your shoes, except that the brush is on a wheel. This brush is covered with rouge, a kind of red powder. Rouge is also used for polishing glass, metal and gems.

The earth's great "Stone Book" tells of the period in the earth's history when coal was formed; how the material for rocks is made and laid in the bottom of the sea and about the different periods in which the successive forms of life appeared. The earth historians—the geologists—divided its history into twenty-one periods. The oldest rocks were made some 80,000,000 years ago! The first form of life to appear was that of the spiral-shelled creatures. Then came shelled creatures like our snails; next the trilobites, with queer horns and spines. In the coal period are found monsters somewhat like our crocodiles, and after these, dinosaurs, whose form was something of a cross between the kangaroo and the crocodile; after the dinosaur, a fish-like creature with a long upper jaw and fins. In the newest formations are found the bones of the elephant-like mastodons.

The Long Strange Story of a Bucket of Coal

This is how the forests looked in the days when nature started to make our coal. "How was this picture taken?" you ask; "they didn't have cameras in those days, and there was nobody to operate them if there had been." It was drawn from information geologists got from such things as the leaf imprint in the "dusky diamond," shown on another page.



"DUSKY DIAMONDS," what an odd name to call coal! Then how do you like "enchanted forests" or "buried sunshine?"

Those names puzzle you still more. Diamonds, coal and trees are so very unlike each other, you think. And how could sunshine be caught and buried?

Well, let's see. Many things that seem unlike are really the same, or at least near relations. Water, you know, is sometimes steam, or snow or ice. The fire on the hearth and beams from the sun both give light and heat. Trees could not turn green and grow without sunshine. They soak it in through every leaf-pore, and store it away in roots, trunk and bark. When burned, wood gives all that stored up heat and light out again. Coal, too, makes a bright, hot fire. If made hot

enough, a diamond burns with an electric blue flame, with no smoke.

Diamonds, coal and wood have carbon in them. Carbon burns only in air. It does not melt in water. The diamond is a carbon crystal, as a snow-flake is a water crystal. Coal is only six to nine-tenths carbon. It has water, sulphur, phosphorus and other impurities in it. Only the dry fibers of wood are carbon. When coal is roasted in an air-tight kiln, many impurities are driven out in gases, leaving the carbon and some minerals behind, as coke. Wood roasts to charcoal. Animal bones roast to charcoal, too. There is carbon in all woody fibers and in animal bones. Graphite, or the lead in "lead" pencils is a carbon. So is jet. Indeed, your jet buckle is just a kind of coal.

Under a microscope you can see great differences in the carbons. The diamond glitters. Graphite sparkles, as a snow-bank sparkles, from many tiny crystals pressed together. Jet and hard coal shine. In charcoal the wood fibres lie in loose bundles. Coke is a sponge-like mass of fibres and holes.

King Coal's Information Bureau

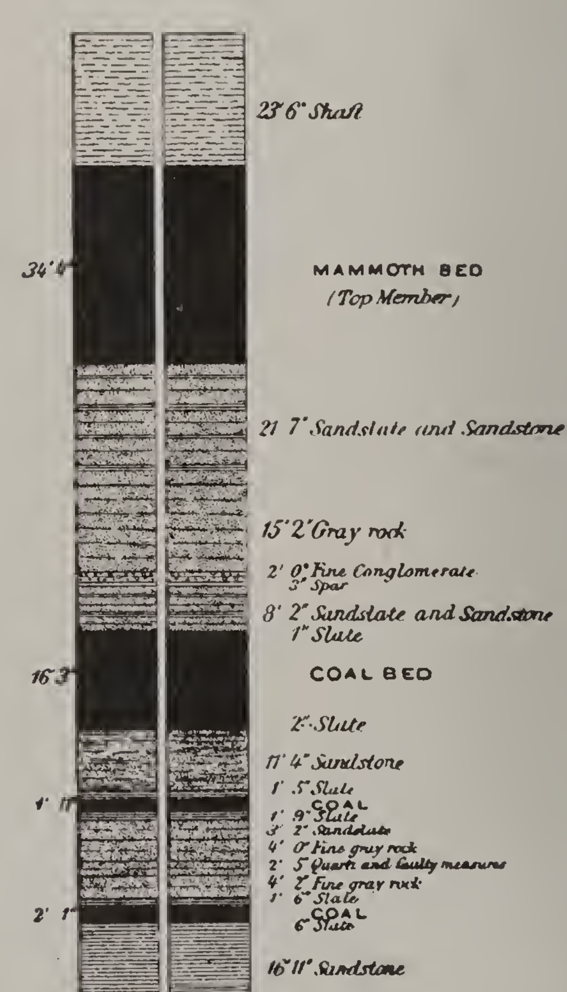
Soft coal splits like wood. Split a block of cannel coal. On a fresh surface you can find leaf stems and scales, mosses and fern-like leaves. It is as hard to find a perfect leaf on coal as to find a perfect, six-pointed snow-flake. In being turned into coal, plants were crushed to powder and then pressed to stone. How?

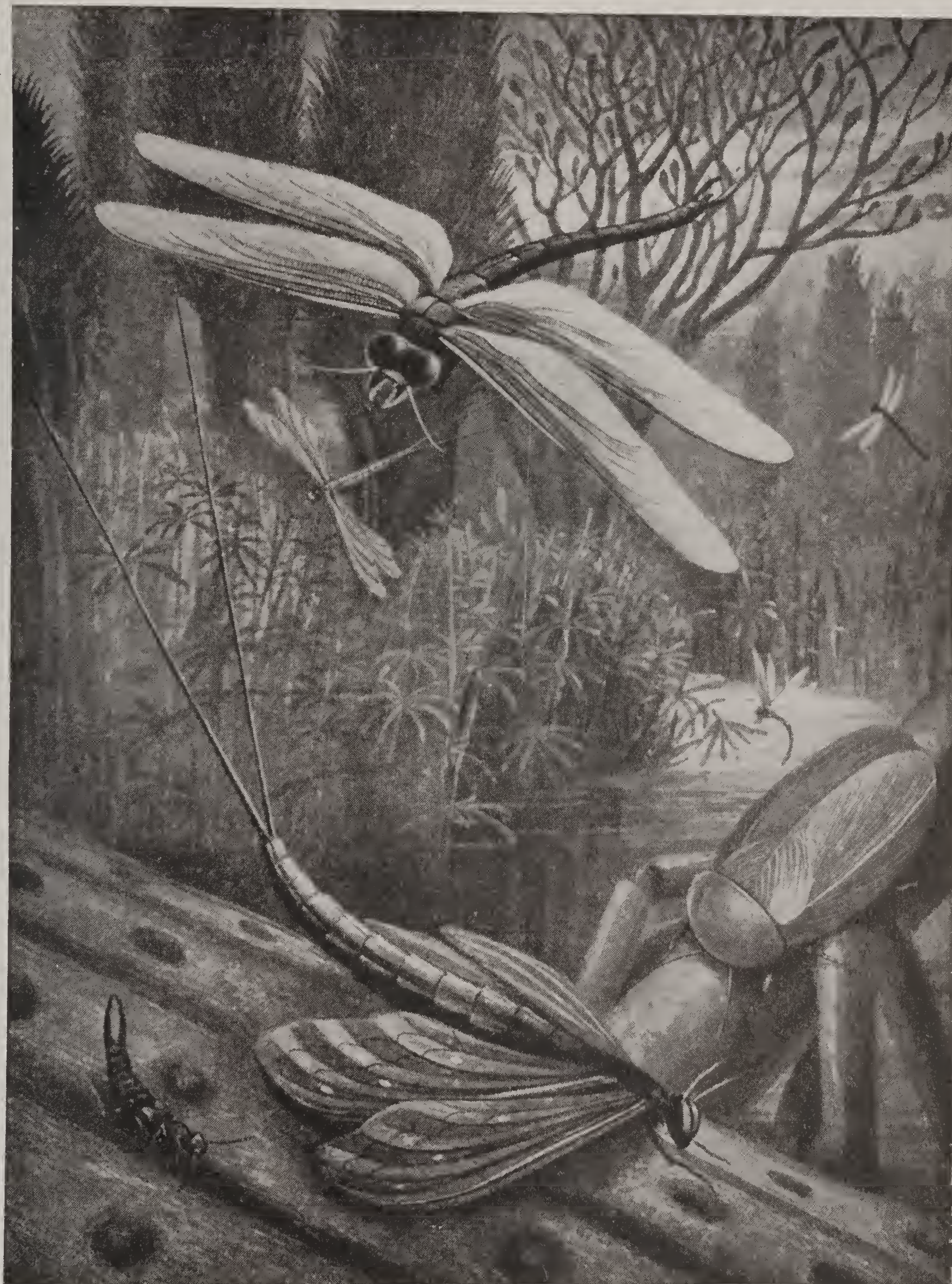
Well, thousands of years ago, there were great forests where the coal fields lie today. Tree ferns, palms and undergrowth were crowded together, on still, hot

Part of the Enchanted Forest

"Split a block of cannel coal. On a fresh surface you can find leaf stems and scales, mosses and fern-like leaves."

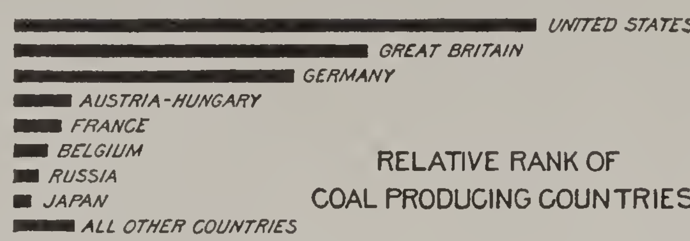
MOUNT CARMEL COLLIERY
STUARTVILLE DIAMOND DRILL BORE HOLE

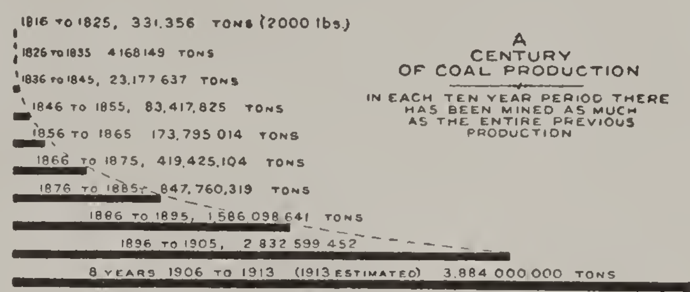




Insects of the Coal Age

Imagine the "still, hot swamps" where "tree ferns, palms and undergrowth were crowded together," teeming with these huge creatures. What a buzzing they made! The dragon-fly in the air is like the one found in a French coal bed. Its wings were 2 feet across. Below are a mayfly and cockroach of that period.





swamps. The swamps lay around the mouths of rivers. Drift-wood was floated down and piled above the roots. Suddenly the swamps sank into the ocean. With an earthquake the land dropped. One moment the green forest waved in the sun. The next moment the trees were crushed on their roots. No light or air reached them. Everything in them that would decay, or dissolve in water, was washed out. Then water was squeezed out. Then the carbon was pressed into coal. Sand and mud covered the coal and were pressed into sandstone, clay and slate. Sometimes the coal lay so long under the ocean that the shells and bones of sea animals were pressed into limestone above it.

But the land was lifted, at last, by another earthquake. Forests grew again and sank. In some fields there are six veins of coal with stone on each. By this coal map of our country you can see just where forests once grew.

Where Our Largest Coal Fields Lie

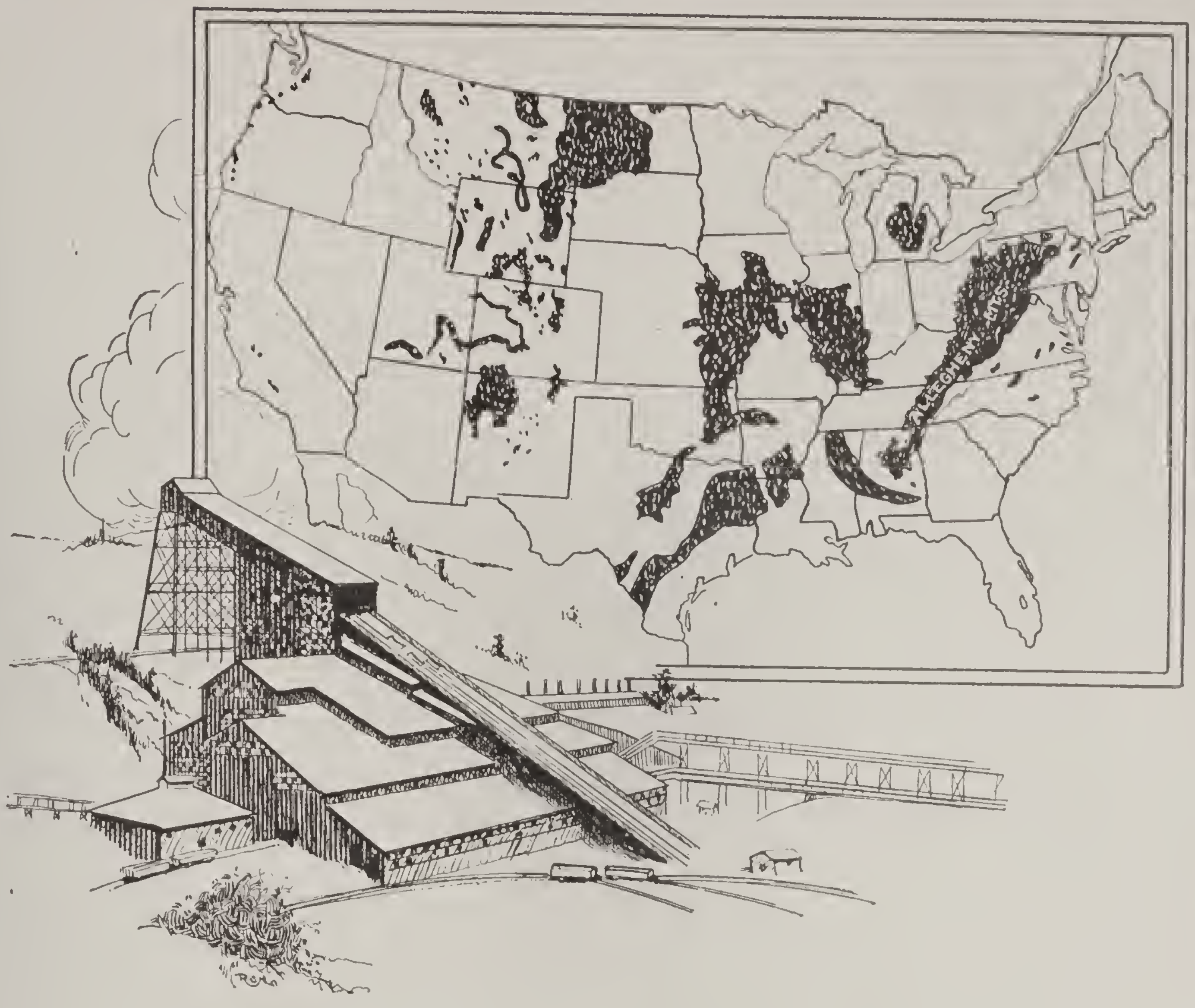
The largest of our coal regions covers the whole western slope of the Allegheny mountains. Two large fields are just above where the Ohio, Mississippi and Missouri Rivers flow together. The Gulf of Mexico came up to the Ohio River in the coal age, and washed the base of the mountains. The mountains were lower than they are today. You can see how narrow a ridge was, at one time, above the sea, by the small coal field in Eastern Pennsylvania. On the Susquehanna River is the largest and finest field of anthracite coal in the world. This river flows into Chesapeake Bay, a large arm of the sea. In the coal age this bay was much larger.

Most coal mines lie deep, buried under rock, clay, gravel, sand and black soil. But sometimes coal is found on the surface. You see, the earth is lifted, dropped and folded unevenly. It tips up rock layers and cracks them, so coal seams lie at all sorts of angles. In some places they were laid bare by rivers that cut their way through soil and rock. On streams in our coal regions you can see black holes where coal mines have been opened from hilly banks. But most coal mines are entered through up-and-down tunnels, or elevator shafts. The mine is found by boring. Mining engineers can tell by what comes from the hole, just how thick a coal seam is. Very thin layers cannot be worked. We have some coal seams sixty feet thick. Just imagine the forests that made them! It took four feet of wood to make one of coal.

A coal mine shaft may be fifteen feet across and a hundred or more feet deep. It is lined with iron or timbers to keep out water. Men, tools, coal cars and mules, are carried up and down in elevator cages. Around the bottom of the shaft are brick and stone lined rooms for the ventilating pumps, tools, blasting powders, coal trucks and stables.

Down in a Coal Mine

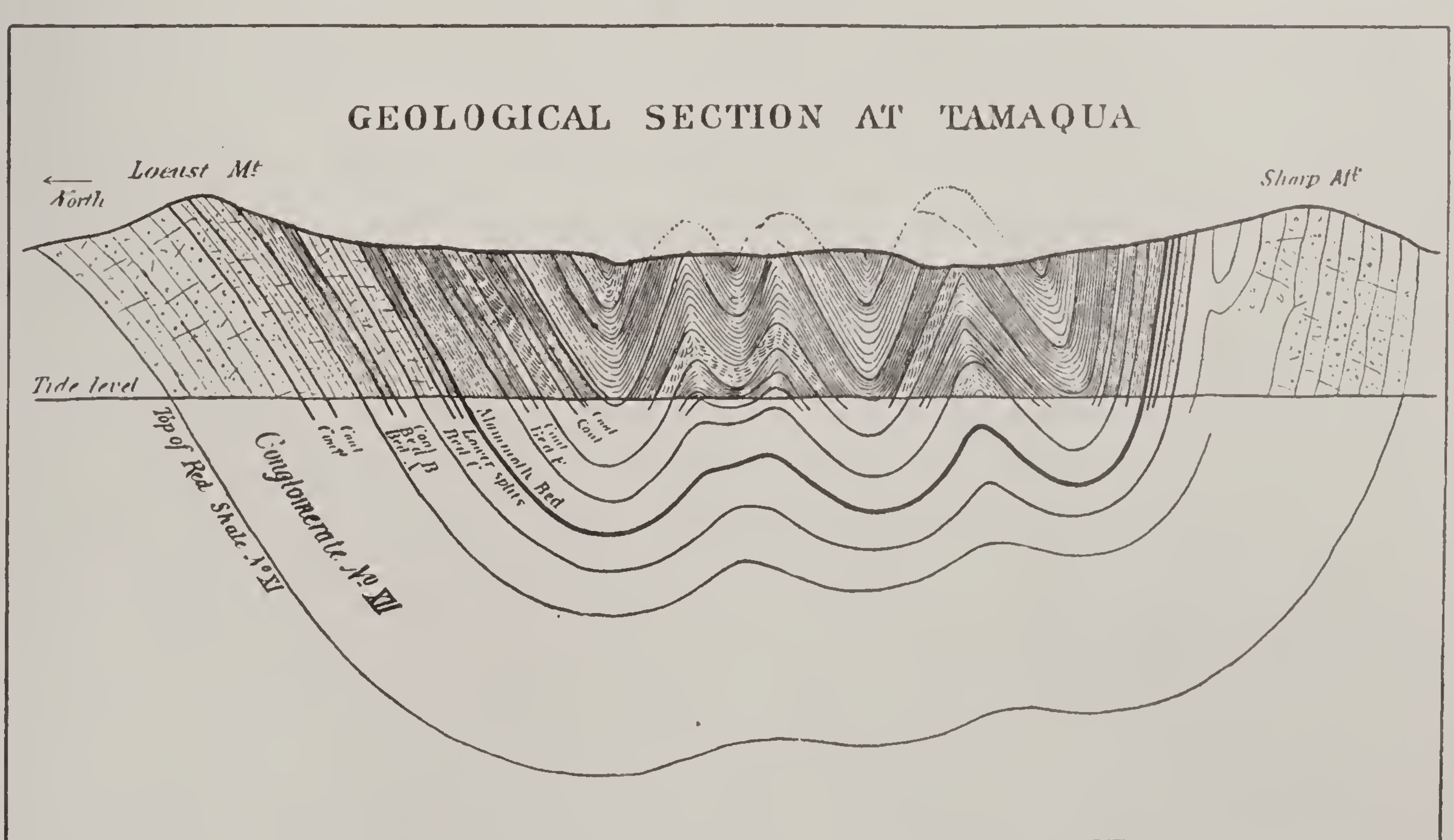
Would you like to visit a coal mine? All aboard! You have to



The Dominions of King Coal

The black spots show the location of coal fields in the United States. The richest beds are in the Allegheny region.

The diagram below shows how twisted and tilted the veins of coal sometimes are. Perpendicular shafts are not always best; sometimes an oblique shaft is sunk following the line of the strata of coal.



The Coal of the Future

Lignite is a low form of coal, between peat and bituminous. It is of comparatively recent origin and has not been considered of much value in the past. But even our vast coal fields will some day be exhausted and then lignite will have its turn. There are over 500,000,000 tons of it in North Dakota alone.

A government scientist recently discovered a 13-foot vein of anthracite or hard coal on government land in Colorado. There are only a few places outside of Pennsylvania where this kind of coal is found.

climb into a cage at the top of the shaft. You had better wear your oldest clothes. You go down with the miners who are black with coal dust. They are so black they look like negroes.

Down you go, just as you go in the elevator of a tall building. You go into the blackest night. At the bottom there are electric lights in the engine room, tool rooms, and stables. The miners stop for picks, wedges, hammers, and drills. A safety lamp is fitted to each man's cap. The lamps have chimneys of wire gauze that cover the flame. The flame cannot get through the gauze, nor enough gas-laden air get in to cause an explosion. The men are not allowed to smoke pipes or to carry matches. The coal trucks are pulled by mules or electric motors. Locomotives cannot be used in coal mines, on account of the gas. Just smell it! It smells like a furnace when you put fresh coals on the fire. The ventilating fans pump fresh air into the mine and blow as much bad air out as they can.

A Children's Coal Mine

Fourth-grade children in the Benton School, Columbia, Missouri, modelled this mine. They did it while they were studying about coal mines in geography. See the track, with the wooden car on it, leading into the entrance to the mine. It will really run into it, too, and can be pulled back.

The Tunnels in the Mine

From the bottom of the shaft, galleries or tunnels run out along the coal seam. The mine is like a city of narrow, black streets without houses. A railroad track runs through every tunnel. Great rooms are cut out of the coal on either side. Pillars of coal have been left, and timbers put in to hold up the stone roof. You can see them, at every turn, glimmering in dark caverns. Every sound is echoed from the walls—the trotting of iron-shod mules, the rumble of the trucks, the clang of picks and hammers, the shoveling of coal. You jump at what sounds like a far-away cannon shot. Tons of coal are brought down by blasting.

The Miner's Goodbye

This statue, by Charles J. Mulligan, shows us the sad side of a miner's life. When the miner says goodbye to his wife and children every morning he knows that one of the terrible accidents that happen daily, in spite of the greatest precautions, may befall him. That is what makes him cling so closely and tenderly to his little girl. And the child, little as she is, knows that sometimes other little girls' papas don't come back from that great deep hole.

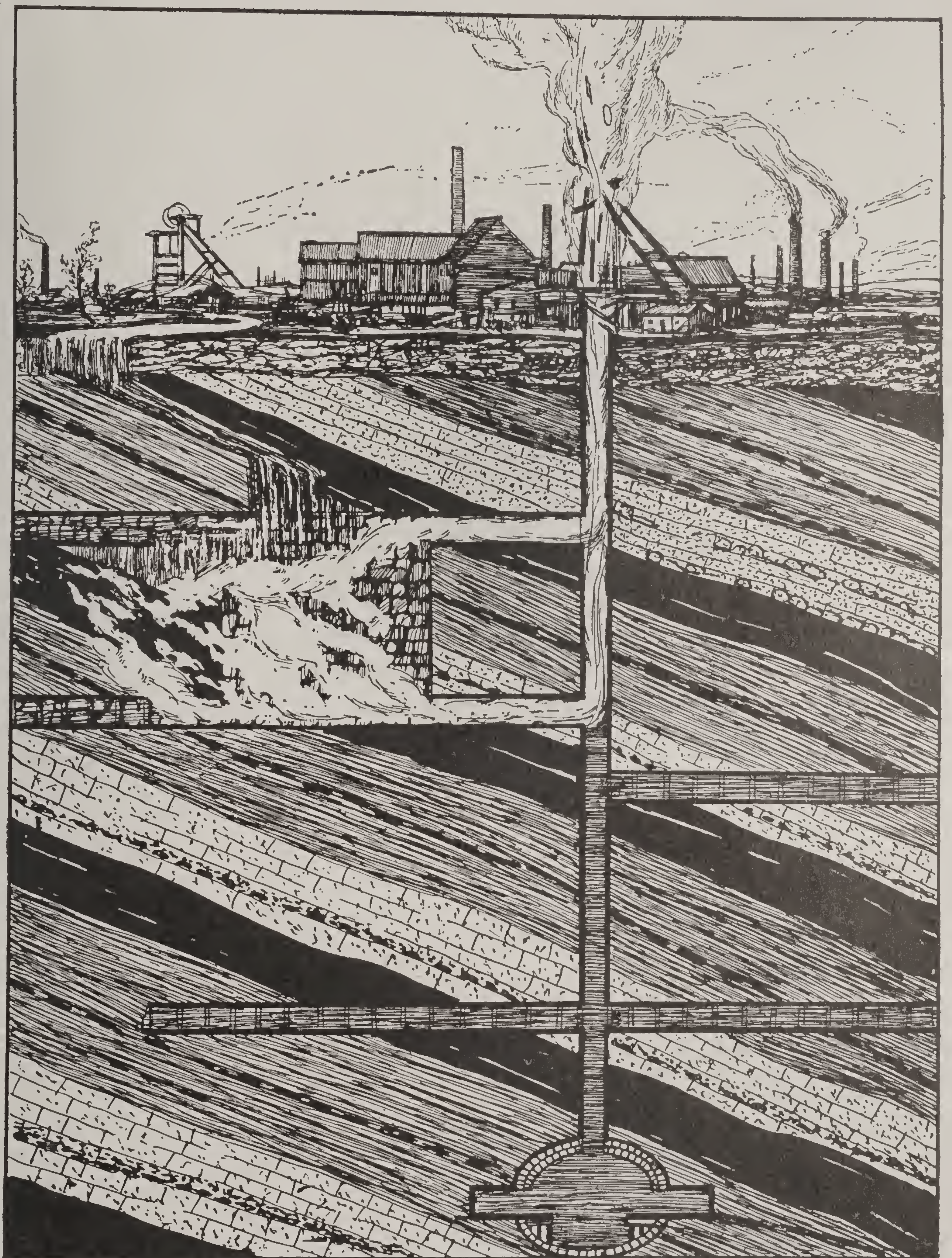
A Dark and Dangerous Place

Such a dark and dangerous city! The drip, drip of water from a roof makes one nervous. Sometimes an underground stream breaks in and floods a mine.

When Fire and Water Meet

Many mines have a corps of fire fighters at work constantly, extinguishing the fires which occur so easily in their inflammable product. Sometimes a fire gets beyond control and burns in one part of the mine for years while miners continue to work other parts of it regardless of the roaring furnace so near them. This is the diagram of an English mine in which such a fire was barricaded with thick brick walls. A little river in time of flood, broke through the upper gallery of the mine and reached the burning area.

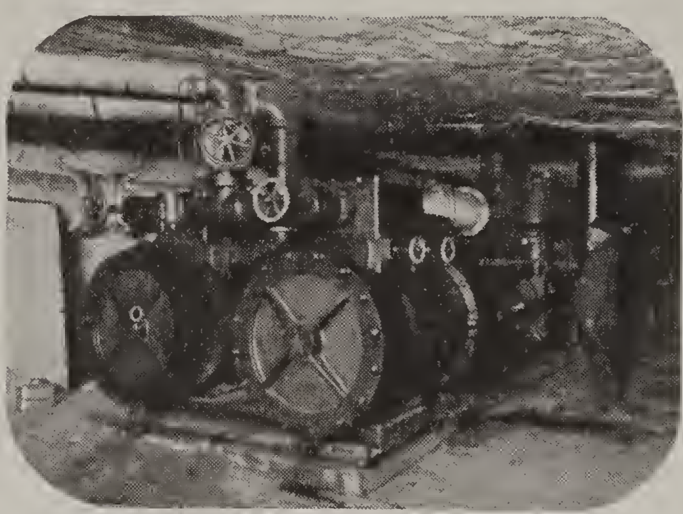
Water Sometimes Destroys Mines



The steam formed when the water came in contact with the fire shot a stream of water up the shaft of the mine like a waterspout. With a rush and a roar, winding tackle, timbers and machinery were carried three hundred feet in the air. The fire was put out but the mine was destroyed.

The Men Who Dig the Buried Forests

Thousands of men are employed in American and European coal mines. These are English miners just after the closing whistle has blown.



The engine is pumping water out of the mine. Sometimes these pumps have to be kept running constantly.

Sometimes the coal and timber supports give way, and a gallery of men are walled in with rock and coal. Explosions of gas and coal dust choke men to death, or turn a mine into a roaring furnace. Every miner knows the plan of a mine as well as you know the streets and byways of your town. In a big mine there are several ways out. If made prisoners, miners know their mates and employers will try to dig them out. They knock on the wall with picks to tell where they are. But sometimes they are found too late. Their prison has filled with

After the Day's Work

These miners are going back from work in the cars made for that purpose They spend every day, week after week, underground and their work is usually dangerous as well as dirty.

"First Aid" Work in the Mine

Since the United States Bureau of Mines showed them the way, many mining companies have organized corps of rescue workers among their miners, and have fitted them out with the necessary equipment. A course in first aid and rescue work, including instruction in how to use an oxygen helmet, is given the miners making up these companies. In the picture at the top of the page you see two of them binding up the broken arm of a wounded comrade.

People used to think that mine explosions were never caused by coal dust alone, but that gas had to be present, too, but the experiments of the United States Bureau of Mines has proved that this does happen. Coal dust was put in a steel cylinder six feet in diameter and one hundred feet long, like the one in the picture at the bottom of the page. A shot was fired into it by a cannon to provide a shock like those that occur daily in a mine where blasting is going on. The coal dust exploded with great violence. The picture here shows the tube when an explosion is taking place. When there are other things mixed with the coal dust, such as rock dust and ashes, explosions do not occur.

As a result of the knowledge gained by this experiment rock dust, ashes and common roadway dust are spread on the floor of the tunnels and this is kept stirred up by the traffic back and forth to the elevator shafts.

Collecting Marsh Gas

The deadly marsh gas that occurs along with other gases in mines is also found rising in bubbles from swamps and pools of stagnant water. The small picture shows how some was collected for experiments.

One of the Government's Experiments with Coal Dust

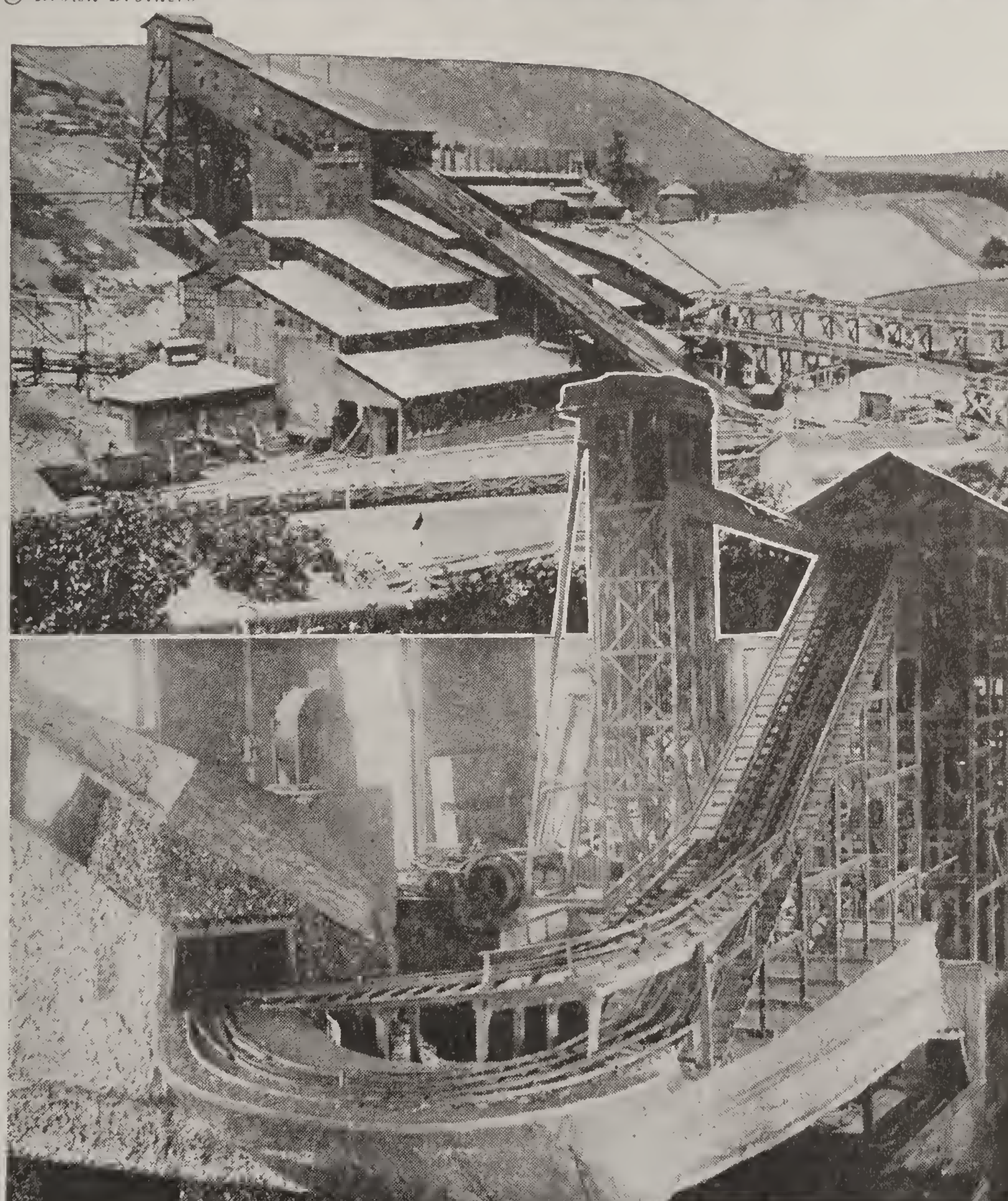
In the Underground Dungeons of King Coal

See the cramped position in which miners must work. The heavy posts are props for the coal walls.

The lower picture shows an electric trolley line for coal. It is operated by the lever attached to the trolley connection on the first car. How low the ceiling is—a tall man could barely stand up straight.

All Aboard for Up the Shaft!

© *Brown Brothers*



Ready to Come Up from the Mine

The coal trolley ends here and the car loads of coal are hoisted up the shaft on this elevator which is run by the big chains which you see at the sides.

Through the Breakers Next

In the upper half of this picture are the breaker buildings of a coal mine. They contain crushing machinery, like that which is diagrammed on the following page, and breaker runs where the slag and rock are removed from the coal. In the lower half is a model coal breaker in the Mining Museum at the Pennsylvania College of Mines. With this kind of a breaker no workmen are needed.

The Crushing Machine at the Top of a Breaker

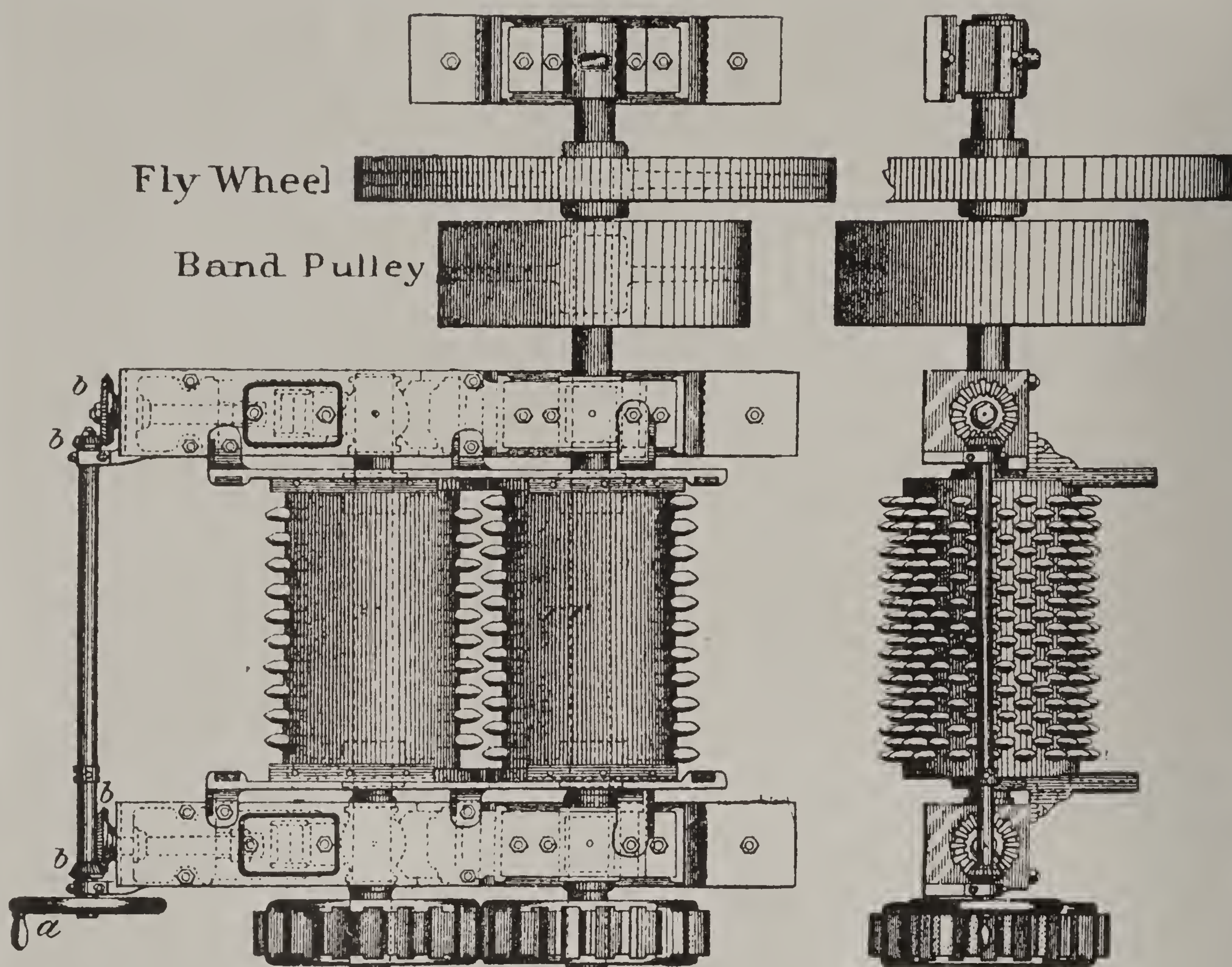
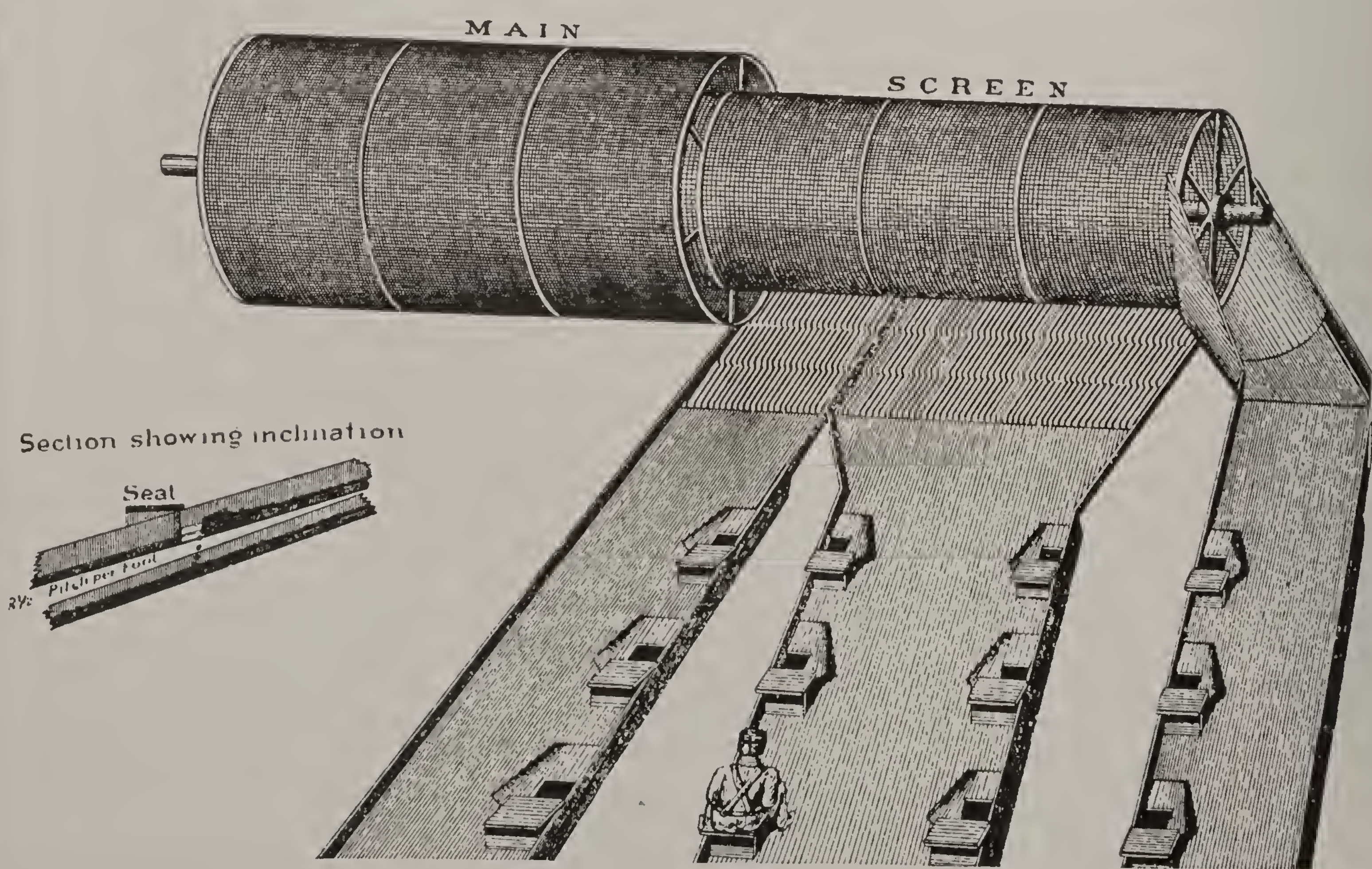
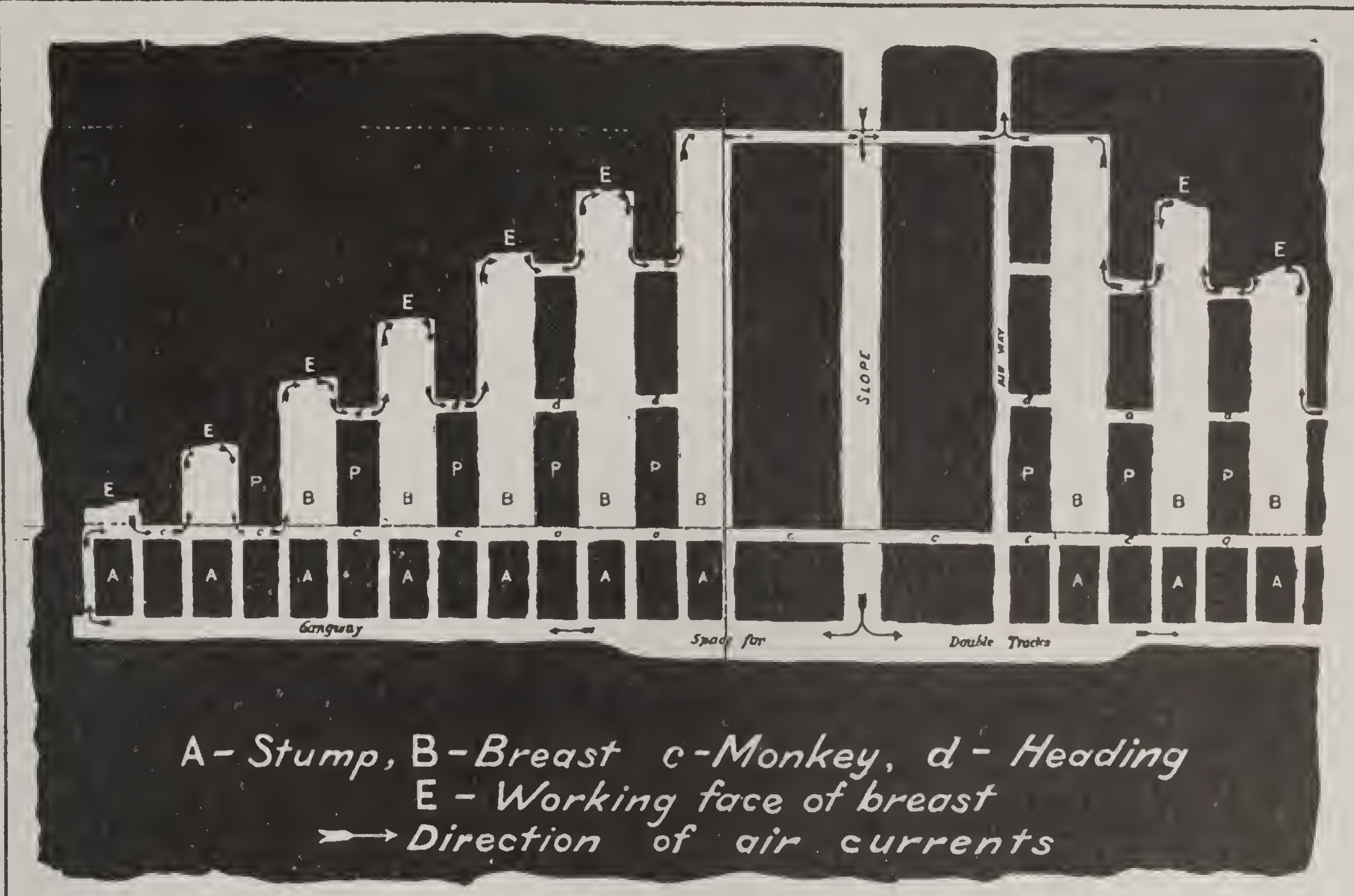


Diagram of a Breaker's Picking Table



Where Fresh Air is Precious



A good supply of pure air is absolutely necessary in the gas-laden passages of a mine. And the air must be kept moving to prevent explosive gases from collecting. A strong current of air, almost a wind, is continually blowing through a mine. The chambers are connected in such a way that with the help of doors or gates, the air current can be sent in the direction most needed. The diagram above shows you the route an air current takes through the mine. The vein of coal is slanting, so none of the passages are horizontal. The working face, E, is higher than A. The miners are working at E loosening the coal and the force of gravity makes it flow down the passages.

deadly gas.

Anthracite coal is very hard and clean. It is nine-tenths carbon, so it makes a hot fire, with little smoke. Did you ever wonder why it came in certain sizes? It comes from a mine in big blocks that have to be broken. A coal-breaker is a crushing mill. As the broken coal falls, it is sorted by screens. Then as it slides down chutes, boys pick out bits of stone and slate.

The soft coals break up themselves. Some kinds go to dust. Of these some are best for making steam, or gas, or coke, for smelting iron in blast furnaces. A penny pipe fitted with clay into a kettle filled with coal dust set over a fire will make gas. There are gas works in every city, and long rows of coke ovens near big steel and iron works. If we had to use wood for smelting iron, iron and steel would be so dear that we could use very little of it. Without coal, factories would stop, streets would be dark, houses cold.

Did you ever wonder why coal came in certain sizes? It comes from a mine in big blocks that have to be broken. A coal-breaker is a crushing mill. The upper picture on the oppsite page shows you diagrams of the rollers that break the coal. The coal is hoisted to the top of a breaker, a truck load at a time, and thrown into a slanting bin above the machine. As the coal runs down between these rollers it is crushed by the steel teeth. The dotted lines on the left hand diagram represent the parts covered up by the outer casing. One roller is turned, you see, by the band pulley around the smaller wheel. An arrangement of interlocking cogs at the bottom of both rollers turns the other over. The other diagram shows how a roller looks from the outside.

As the broken coal falls it is sorted by screens. Then as it slides down chutes boys pick out bits of stone and slate. The coal runs down the chutes of the breaker picking tables on the opposite page because they are tilted downward.

"Eating On the Run"

This steamer was hungry. She had eaten up all the coal in her bins but the many busy people on board could not wait for her to stop so she is "coaling up" from the coal steamer nearby while both are traveling at the rate of ten miles an hour.

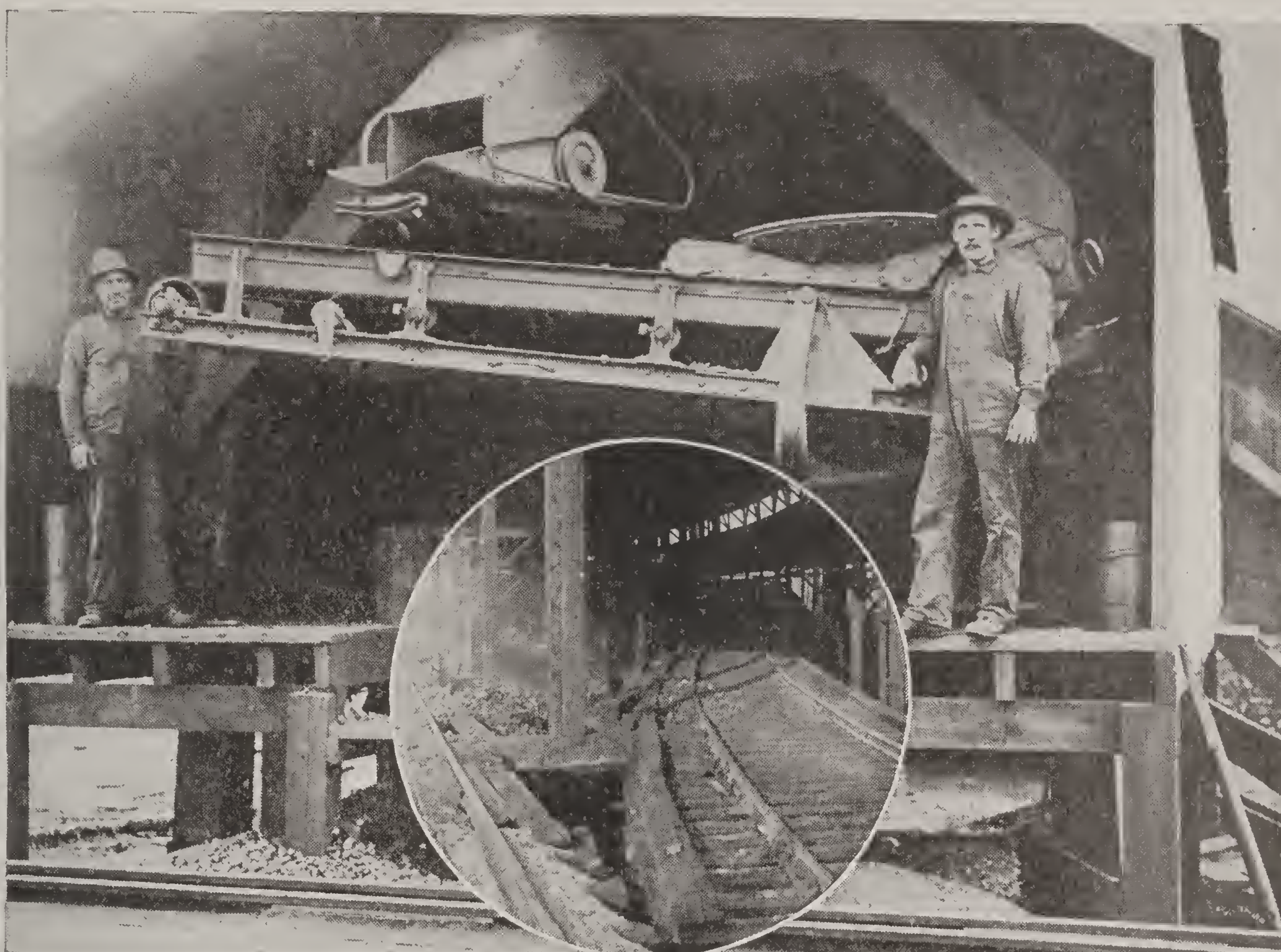
You know how many ashes are made by a coal fire. An ash is a mineral. Trees have lime and iron and other minerals in them. Some of these were washed out when wood was turned into coal. But sulphur and phosphorus were washed in. And sand and clay were pressed into the cracks. When heated, the sand and clay bake into glassy "clinkers" that you have to shake and push out of grates. The sulphur and phosphorus make those bad smelling gases that come from a coal fire. They are so unpleasant that you always try to let them go up the chimney.

But they are not as dangerous as a coal-gas that you cannot smell at all. All of the carbons give off a poisonous, carbonic acid gas. They give it off all the time, when exposed to the air. This is the deadly gas that collects in coal mines. Coal, coke, and charcoal give off this gas most when burning. The oxygen in the air helps it burn up. An air-tight stove or furnace, or a pan of charcoal, can make enough of this gas to kill a sleeping family. It is not safe to shut all the windows in the win-

Boy Scouts Delivering Coal to the Poor

The Boy Scouts of Chicago have decided to use their organization for helping the poor. They investigate cases of suffering and poverty, report to their scoutmaster, then buy coal and deliver it where it is most needed.

From Mine to Grate

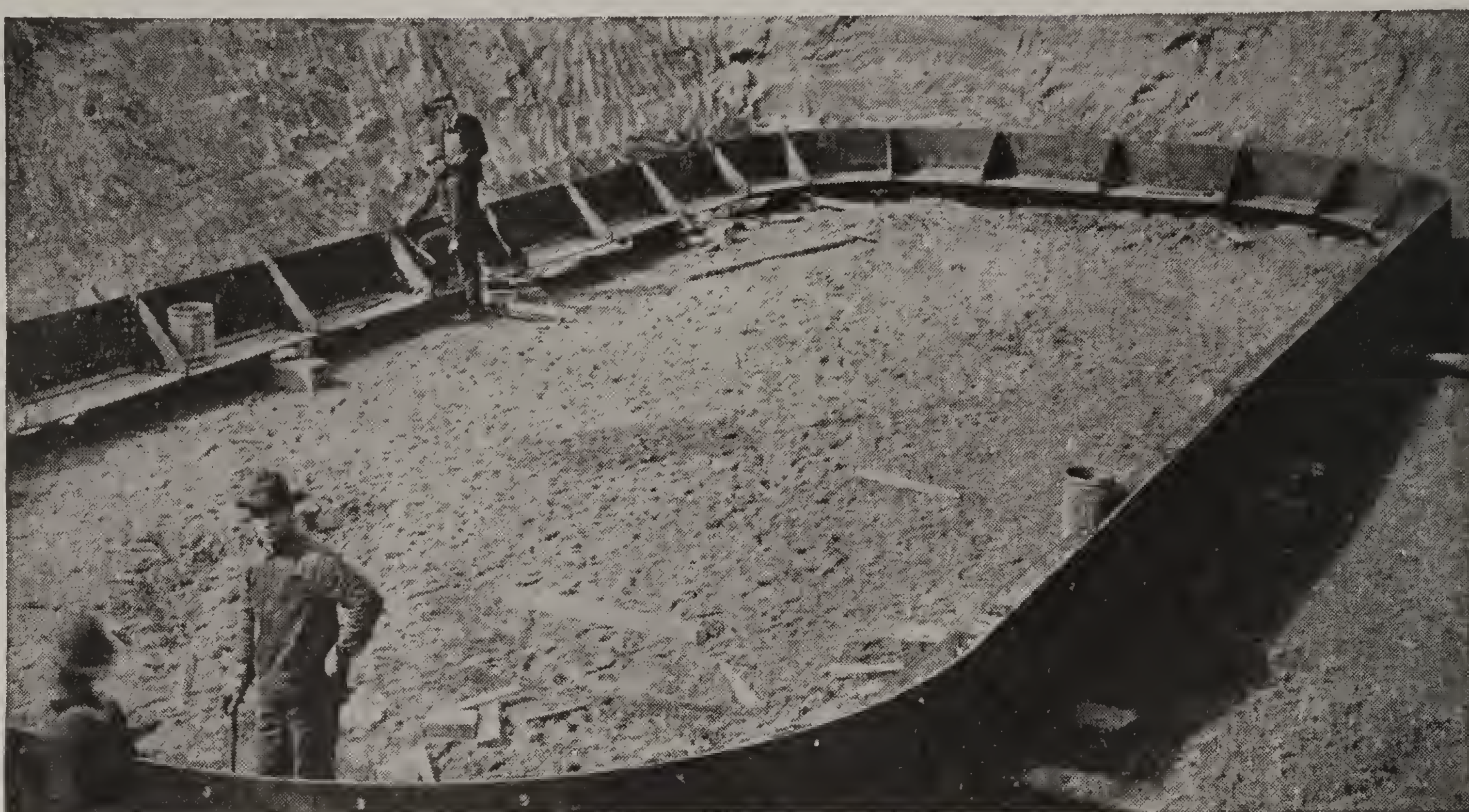


This picture shows us a huge machine for loading coal into freight cars. The cars loaded with coal are run into sheds on tracks like the one in the inserted illustration. The coal is dumped from the cars into bins along the side of the track. These bins have slanting bottoms which allow the coal to run down and out into waiting wagons.

A Summer Home for Coal

There are great round piles of coal in these round sheds. It is unloaded from ships by machinery into these storehouses in the spring, then reloaded in the same way in the fall when it is needed.

Beginning a New Mine



This big iron frame marks the place where the shaft of the new mine will be. The lower edge of it is sharp and sinks into the soil easily. The upper part is trough-like as you see and will be filled with concrete. The workmen will dig out the soil under the frame and the weight of the concrete will make it sink downward. More concrete will be added as the frame gets lower until it strikes bed rock. The concrete will then form the walls of the shaft and the frame will be the foundation.

ter when fires are burning.

In pine-like trees that were made into coal, there were oils, gummy resins, and pitches that would not mix with the sea-water. They were locked up in the coal. You will be glad of that when you learn that it is these things that make the beautiful colors and leaping flames. It is cannel and other resinous or "bituminous" soft coals that make such cheerful grate fires. Smoky crimson, orange, and gold tongues of fire dart out. They climb the chimney to catch the gases and carbon dust before they can escape.

Beside a grate fire is the pleasantest place ever a child can sit in mother's lap to be rocked. The flames are *fire fairics* playing tag.

Shower Baths for King Coal

Anthracite coal is so dirty and contains so much slate and stone that dealers formerly sold 2,240 pounds for a ton, the extra 240 pounds being counted as waste. Now the coal is washed to remove the dirt. In the picture water is being sprayed over a moving channel of coal. After this the coal is stirred in a large vat where the heavier impurities sink to the bottom while the coal passes on and is dried for market.

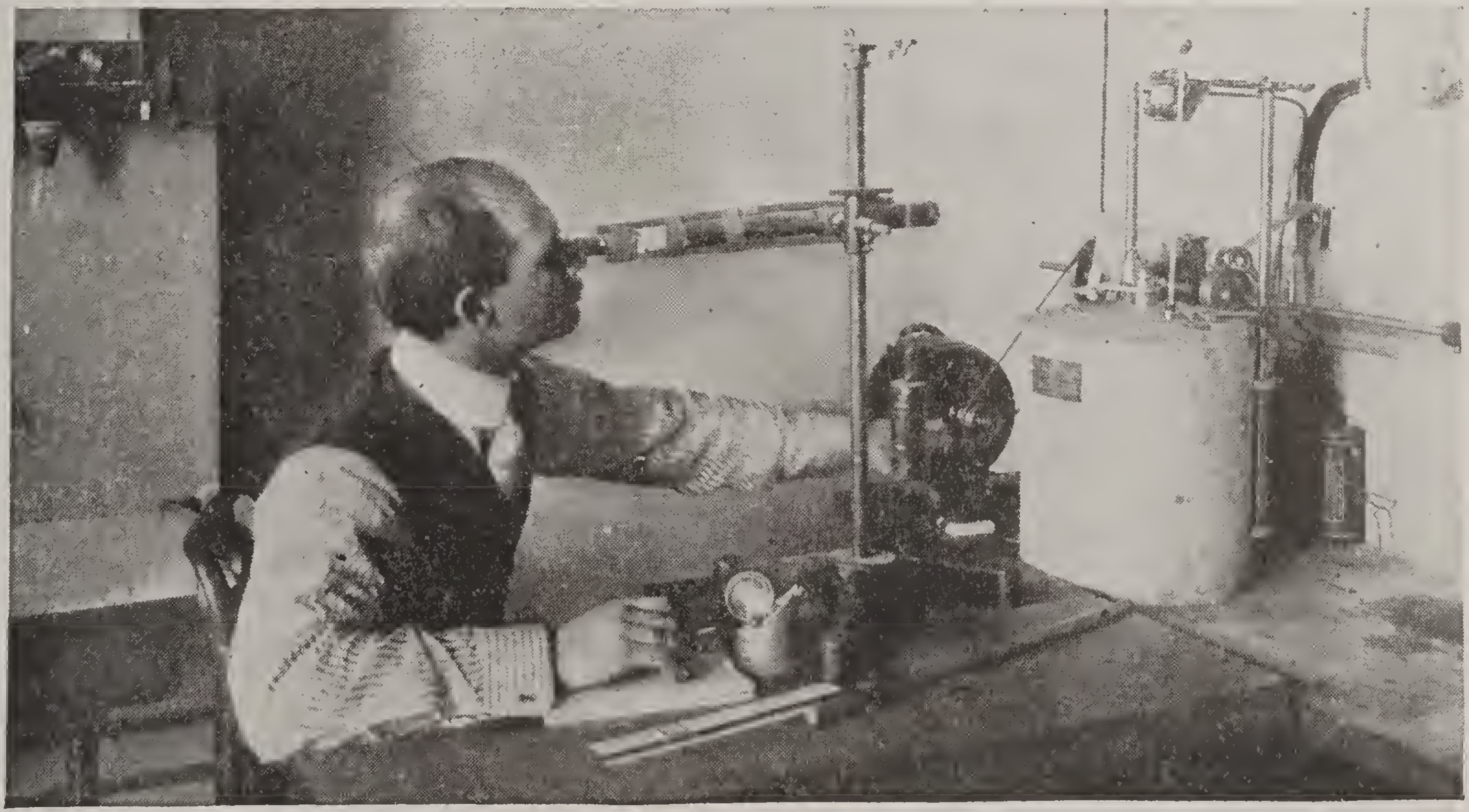
Placer Coal Mining

In the early days of coal mining the small, broken bits of coal mixed with waste were thought to be useless so they were collected in great heaps called culm piles. Many of these were washed away, scattered or dumped into streams. Now dipper dredges like the one in the picture bring up this coal from river beds. It is put into steel buckets which are loaded on flat bottomed scows and towed ashore. There it is sorted and shipped to market.

There are blue and violet grottoes in the hollows, and creeping flickers. You can see pictures and stories. Why, the flames might be that long buried forest of ferns and palms, flashing up to the sun! The flickers are wood and water nymphs dancing along the glittering aisles of swamp. But mischievous gnomes and goblins are hiding in the rock caves of the ocean to drag the forest under the waves. Such a murmuring of leaves! Such lovely, drowsy music of waves on the shore. It's mama singing a lullaby.

At bed time, by the fire, one little girl used to say: "My mama has such sweet, sleepy tunes in her voice."

How Uncle Sam Saves Himself $4,000,000 a Year on His Coal Bill



This man is a government expert testing coal for its heat producing qualities. He is looking through a magnifying glass at a tiny scale which is registering the heat units produced by the coal which is being burned in the enclosed vessel. These tests are made before buying the great quantities of coal needed by the government for the navy and other departments. By buying the best coal, that is, the kind that produces the most heat, four million dollars a year is saved by the government.

Three Woolly Bottle Babies

Baby lambs usually come in the spring when trees and flowers are beginning to blossom. These babies' mothers refused to nurse them so they have to be fed milk from a bottle just like baby boys and girls. Wouldn't you like to be the little girl in the picture so you could pet one of the nice, woolly, little creatures?

THE FLEECES THAT KEEP US WARM

DID you ever see a black sheep? Perhaps you thought that the old Mother Goose rhyme was a joke like the story of the whale that Peter tried to catch in his mother's pail. Most sheep are white. Some are the silvery gray or fawn color of "natural wool" underwear. But in England there is a breed of sheep as black as the Tar Baby of Uncle Remus. They are no larger than other sheep; that is they are about as big as a good sized dog. It would take a whole flock of them to fill three bags with wool.

Think, then, how many sheep there must be, so that we can have all the woolen clothing, blankets and carpets that we need! And —just think—it takes a sheep a year to grow one fleece. To make a living a sheep farmer must have hundreds and even thousands of animals, and miles of land for them. But sheep do not need as much food as cattle, and are not "fussy" about what they eat. They grow fat on the scanty, brown grass of South America, South Africa and Australia. They feed contentedly on the stony mountain slopes of Scotland, Mexico, Canada, and our own New England and Rocky Mountain states. In smaller flocks they are kept on the poorest pastures, on countless farms all over our country and Europe.

Sheep Never Complain of the Board

Life on a Sheep Ranch

A mountain sheep country is often beautiful, with its snow-capped peaks, wooded slopes and deep, rocky valleys. But it is

lonely. A ranch may be fifty miles from a railway station, ten miles from a neighbor. So it has to be a small village in itself. Besides the owner's house, and barns for horses, there must be a foreman's house and office, a store, a blacksmith's shop, houses for the herders, a washing pen and a clipping and baling shed. There is a teacher for the children. Little folks have ponies to ride. The owner has a telephone to the nearest town.

The Shepherd and His Dog

The shepherd stands leaning on his stick with one faithful helper by his side. He is watching his other dog round up a stray sheep and get it back with the flock.

When the Poor Sheep Get Lost!

If sheep are not watched they wander from the flock. In storms they drift into low places and are snowed under. Sometimes a frightened sheep bolts. Thousands of animals may follow, crazy with fear, and go headlong over a cliff, into a gorge. In our western country each herd is followed by shepherds who live in covered wagons. The ranges are not fenced. The sheep go up the mountains in the summer, but come down to the valley in the winter. They eat everything down to the roots, even to young seedlings in the woods, so they are not allowed in the government's forest reserves. In Australia the ranges are fenced with strong wire netting to keep out the grass-eating rabbits and kangaroos. Herd riders examine miles of fence every day. In many countries shepherds have summer huts on the mountains.

How the Collies Look After the Sheep

Faithful Servants of the Shepherd

All sheep men use dogs. We know the Scotch collies best. They are so beautiful and clever and affectionate that we make pets of them. They are white and tan, often with big black patches. Their glossy coats are long, strong and waving. They carry their bushy tails proudly, like plumes. Their

big brown eyes are so loving, intelligent and anxious to do right. There are fine gray sheep dogs, too, and black and white English shepherds. With their keen fox noses sheep dogs can follow lost lambs for miles; and find flocks in drifted glens. At a word or a look from the master, a collie is off, like a bright, ambitious boy in an office, when sent on an errand.

Sheep dogs and men must be patient but firm with a flock. Dogs seem to know that sheep are very foolish creatures, very timid and helpless. They say to them as plainly as possible: "Do as you are told, children, and I won't let anything harm you."

Many Enemies of the Gentle Sheep

Sheep have many enemies. In every northern country, there is some kind of wolf. We have the timber wolf and the coyote, or prairie wolf. In South Africa, a hungry lion sometimes visits the fold. In South America, there are mountain panthers, wild dogs and big eagle-like vultures. Sheep dogs fight all these wild beasts. Sometimes they are killed; or they die after too long tramps in snow-storms without food. But a good sheep dog is always ready to give his life for the flock.

"Wake Up, Master, Wake Up!"

This little shepherd boy sleeps in the fold with his sheep. Yesterday both boy and dog roamed far and wide with their flock and they were very tired. It is morning now, but they are still sleeping soundly. The sheep see the sunlight streaming in through the window and are anxious to be off to the sweet, grassy hillsides. See how they crowd around their young master.

The Tender Care of the Little Ones

In lambing time, they seem never to sleep. If a lamb comes into the world on a cold night, it may die. The mother has too little sense to try to keep it warm. The dog noses about through the flock. Suddenly he barks excitedly.

"Master! Come quick! Here's a new baby!"

The shepherd understands that bark. He runs with a warm blanket and carries the lamb to a fire in the hut. The dog nurse is so happy! When sure that woolly baby is comfortable, he scampers away to find another. In the morning the lambs stagger about on their wobbly legs and "baa!" for their mothers. Men and dogs laugh at them. Dogs do laugh—with their eyes, their tails, their whole bodies.

Raising Sheep Babies on the Bottle

Sometimes a stupid mother doesn't know her baby and refuses to nurse it. Then a lamb has to be brought up on a bottle. Perhaps, Mary brought up her lamb that way. No wonder it followed her to school. But it must have taken a good deal of Mary's time to keep that lamb as white as snow.

Sheep are very dirty animals. They perspire, just as you do, but the perspiration is so thick and

A Primitive "Woolen Factory" in France

This French peasant girl guards her flock of sheep day after day. See her shepherd's staff, the heavy cape to protect her from the weather and her wooden shoes. Can you tell what she is doing? During many long hours the sheep graze contentedly and need very little watching, so she brings her knitting along with her to the pasture ground. You know the great woolen industry, with its knitting and weaving began in home weaving and knitting. Could you knit standing up?

greasy that it cakes into a waterproof coating on the wool. This gathers dust and the wool gathers burrs and twigs. But there is a kind of potash in the perspiration. This with the fat, makes soap. So, for the washing that is given before shearing, a sheep is obliging enough to furnish its own soap.

When the Sheep Takes Off His Overcoat

Isn't it nice, on a warm spring day to hang up your winter overcoat? From the way in which they caper about, after being sheared, sheep seem to be glad to lose their hot fleeces. First they are scrubbed in a stream or under a hose. The fleeces are cut with big shears, by hand, or with a little mowing machine that is run by a gasoline engine. In six or seven minutes a skillful man can take the fleece from an animal in one, unbroken piece that looks like a sheep skin rug. The fleeces are rolled and packed into big bales that weigh nearly four hundred pounds.

Shearing With Mowing Machines

How the Blanket Gets on Your Bed

Wool takes a long journey and goes to the same markets as cotton. Like:

"Dainty Baby Austin,
Whose Daddy went to Boston,
To see the King of Oo-rink-tum-Jing
And the whale he rode acrost on,"

that Mr. Riley tells us about, most of our wool goes to this big New England seaport. There, if wool *could* see, in the big warehouse, it would see woolen mill kings who buy wool to keep their factories busy. And it

Wool Takes Long Journeys

would see thousands of other bales of wool that "rode acrost on" perfect whales of ships, from far-away Sydney, Cape Town and Buenos Ayres. It would see long and short haired fleeces, fine and coarse, gray and brown and black, for the bales are opened and sampled.

It would hear some queer talk, too, and learn whether it was to be turned into a soft little shirt for a baby, a piece of challie or veiling for a little girl's party dress, a sweater, a blanket, a boy's rough school suit, a felt carriage robe or a brussels carpet. Different mills make different cloths, and each uses special kinds of wool.

In the Days of Homespun

This is an old-fashioned spinning wheel which was to be found in every home a little over a century ago. Notice the flax at the left which the spinning wheel draws out into yarn at the expense of much hard work of both hands and feet.

Preparing the Wool for Weaving

All factories prepare wool for weaving in much the same way. A man unrolls the fleeces on a table with a top of steel netting that lets the dirt fall through. Each fleece is divided down the back, and then pulled to pieces and graded. The wool on the sides and back is the best. On the under parts and legs it is thinner, and is often ragged. Near the hoofs it is more like hair. Each grade is thrown into a different basket, and is kept separate while it is being washed.

Sorting in the Woolen Mill

It would be a lesson to any little girl who is going to be a house mother by and by, to see how carefully wool is washed in a woolen mill. A foreman could explain why he uses soft water that is neither very hot nor cold; why the wool is just sloshed around gently in mild soap suds in the machine, pressed lightly between loose wringers and dried quickly in warm, clean air.

Did You Know That Wool Has Teeth?

Wool is a kind of hair. Stroked toward the tip it feels silky; toward the root, scratchy. It is made up of teeth, or scales, laid like shingles on a roof, or the scales on a fish. These teeth catch on each other and the fibres mat, or felt, even when the sheep is wearing its coat. The curliness of wool makes it cling more, and when hot or damp, or

What the Wool's Teeth Are For

At the Hand Loom

Here is a woman working one of the hand looms that wove the family supply of linen and homespun in days gone by. Notice the other old-fashioned things in the picture—the spinning-wheel, the rag rug, the queerly made chairs, candles and the andirons of the fireplace. If you ever wove one of the pretty rugs that many girls make in a course in Domestic Science, you know what hard work weaving was, how strong and patient our grandmothers must have been to do so much of it.

if pressed together, it felts. The lime in hard water gets under the teeth, and hardens wool. So does the gummy resin in strong yellow soap. In a mill the fleeces are washed just as a good laundress washes woolen clothes and blankets.

Combing the Sheeps "Hair"

Little curly-headed girls know how their hair is after a shampoo. It is full of "Fairy Tingly-Tanglys." The clean bunches of wool have to be combed, too. Only it does not *hurt* wool to be combed. The bunches are put into a drum, with cylinders set with little steel teeth that pull every fibre separate. The wool comes out a light and fluffy mass, with the tangles gone, but with the fibres lying every way, and with burrs and twigs all through it. Another machine brushes the burrs out; or they are burned out by being run through an acid bath that does not injure the wool.

And Sheep "Use" Hair Oil

After washing, your hair is dry and fly-away for a few days because it has lost the natural oil. Washed wool is too dry and harsh for spinning. It has to be sprinkled with a mist of olive, or tallow and lard oil. Then it is combed or "carded," as cotton is, with teeth-set rolls. The fibres are laid straight with the tips overlapping, in a sheet as wide as the machine.. Then the sheet is divided into ribbons. These pass through the spinning rolls and are twisted into loose, soft tubes that are drawn into yarn threads ready for weaving into cloth.

How Woolen Cloth Is Made

Wool is woven into cloth just as cotton is, on looms. But it takes a great deal more work to finish

woolen than cotton cloth. Cotton fibres are from three-quarters of an inch to two inches long, smooth and free from knots. Wool is from three to twenty inches long, twisty and uneven. It is first woven loosely. When it comes from the loom it looks like coarse bagging, and it is very oily. It is washed again, stretched on frames to dry, and the knots are picked out and holes darned. The cloth is then dampened and ironed between hot rollers. This shrinks it, and closes up all the open spaces. Sometimes it shrinks to half its length and width. If a smooth finish is wanted the "fuzz" is sheared off, and the cloth is ironed again.

A Wool Warehouse in Peru

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This busy scene shows the interior of a wool warehouse in Peru. The Indian women and children are sorting wool and their wages are twenty cents a day.

But in making broadcloth, with a nap like satin, the surface fibres are first picked up with little hooks. They are the same kind of hooks that scratch you sometimes. Guess what they are!

Something Thistles Are Good For

Thistles! The teasel thistle is grown on farms. The heads are gathered and dried, and packed carefully, so as not to break the little elastic hooks that do this work better than any steel teasels. By their stems they are set in rows of holes around a cylinder. This is revolved just above a traveling belt of cloth, and a soft fuzz is pulled up all over the surface. A machine shears this fuzz to an even length, and another brushes it flat, so the loose fibres all lie one way. Ironing "naps" or "felts" it. You have to turn a napped cloth over to see how it is woven.

How Blankets Are Made "Comfy"

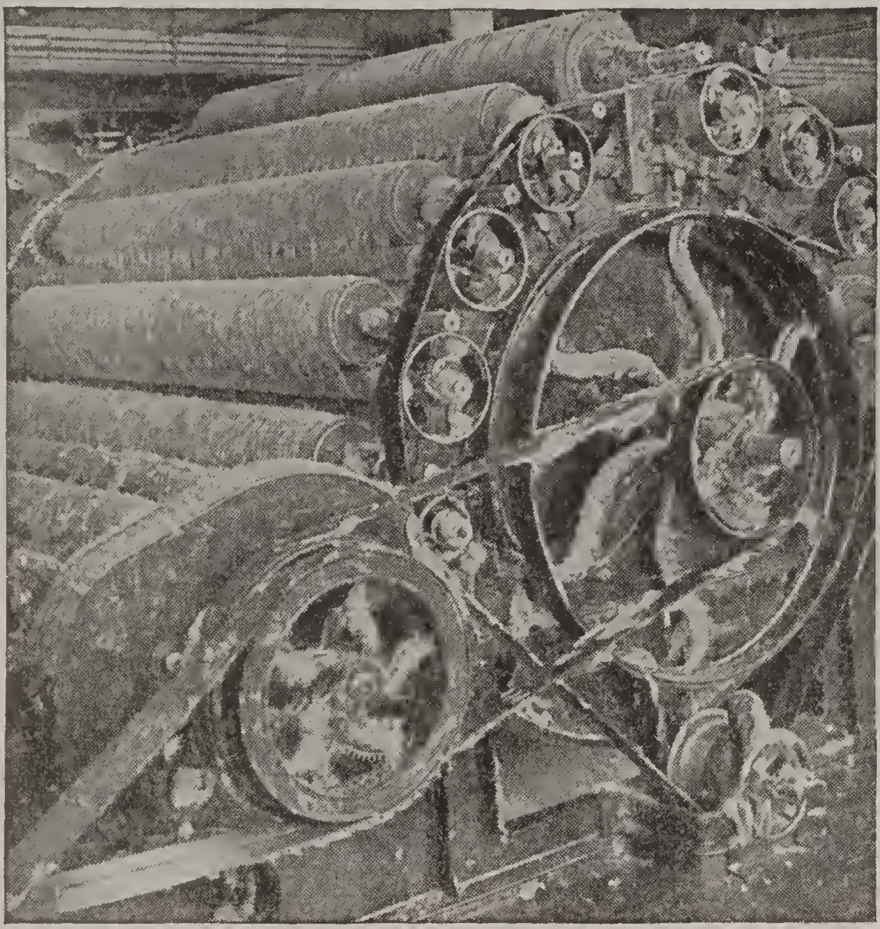
If a plushy surface is wanted, the fuzz is not brushed down, but is raised with hot air. Blankets are left fuzzy to make them soft and "comfy."

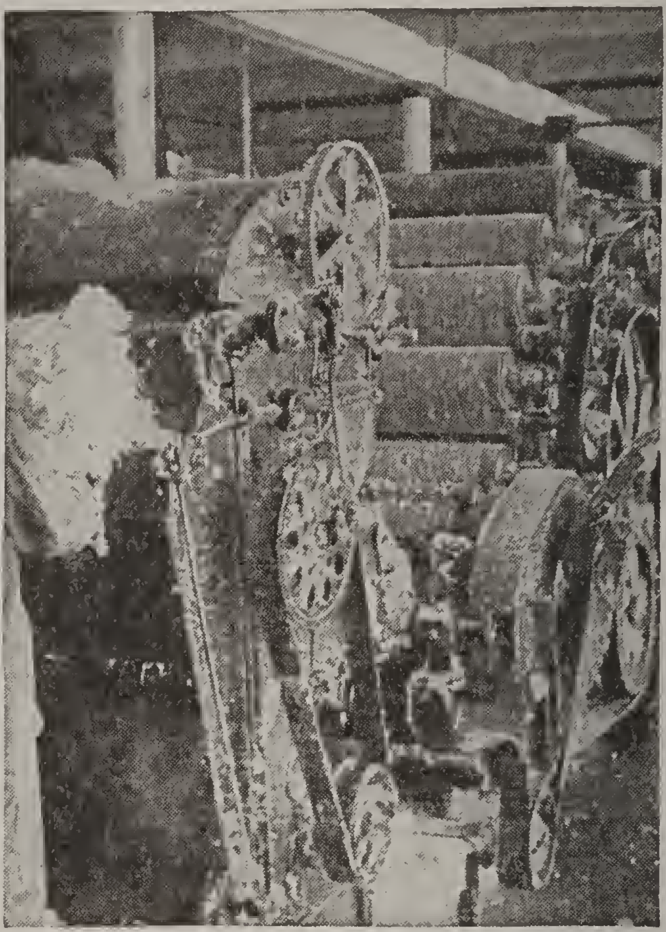
Felt cloth is not spun or woven. Sheets of combed wool are pressed damp between hot rolls. Knitting yarns must be carefully spun from wool with few knots. Underwear, sweaters and stockings are knitted on machines. Hundreds of needles are set in circles. The only knitting machines used to be mothers and grandmothers and little girls —especially little Puritan girls.

What Wise Little Grandmothers

Those far-away, quaint little grandmothers of ours knew as much about wool as the mill men of today do. They had to do all the kinds of work that are done now in the factories. They washed the wool in tubs. They combed it with hand "carders," something like curry combs. They picked the burrs out by hand. They spun the wool into yarn on spinning wheels. They wove cloth and blankets on hand looms. They dyed cloth and knitting yarns with butternut husks,

Combing, Carding and Spinning





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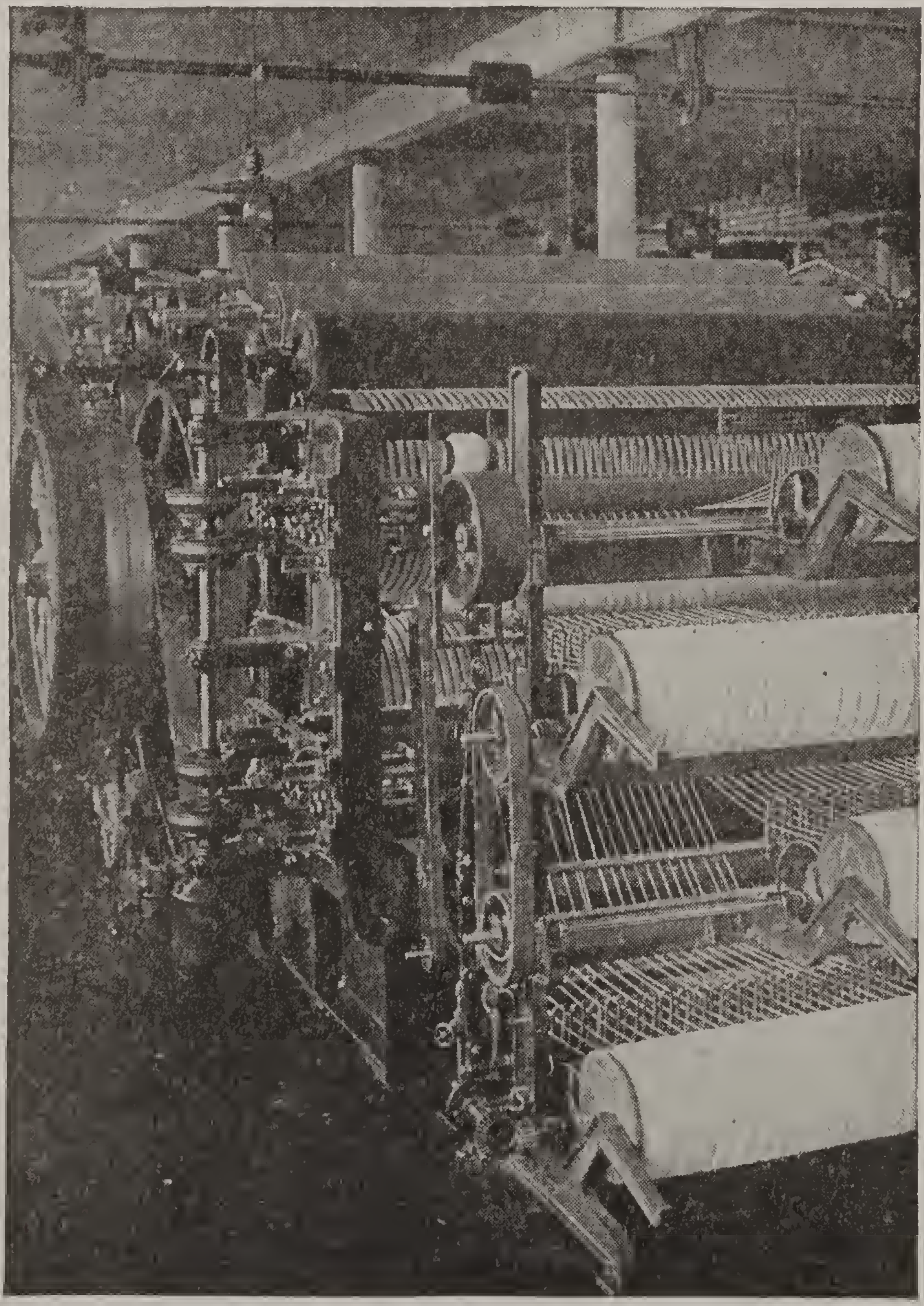

In the upper left hand corner is a picture of the carding machine which untangles and straightens out the wool fibres. You can get a glimpse of the clean washed wool being fed into it at the left of the picture.

The next picture gives you a closer view of the hundreds of "teeth-set" rollers in the machine. See the complicated arrangement of belts by which the rollers are kept rolling. What an enormous job it must have been when carding and combing was done by hand!

"The fibres are laid straight with the tips overlapping, in a sheet as wide as the machine. Then the sheet is divided into ribbons." (You can see these white strips or ribbons in the middle rolls.) "These pass through the spinning rolls and are twisted into loose, soft tubes that are drawn into yarn threads ready for weaving."

Further Steps in Spinning

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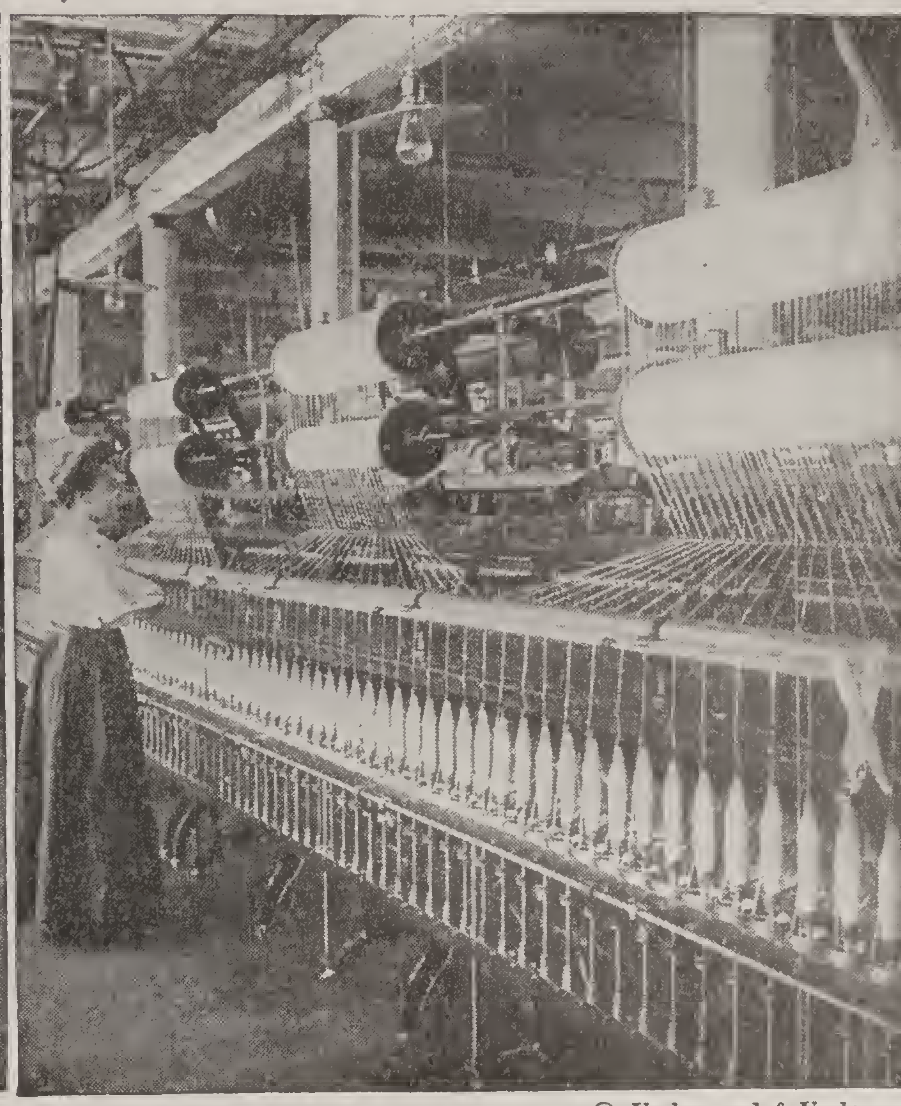
This is the machine that twists the loose woolen tubes into yarn.



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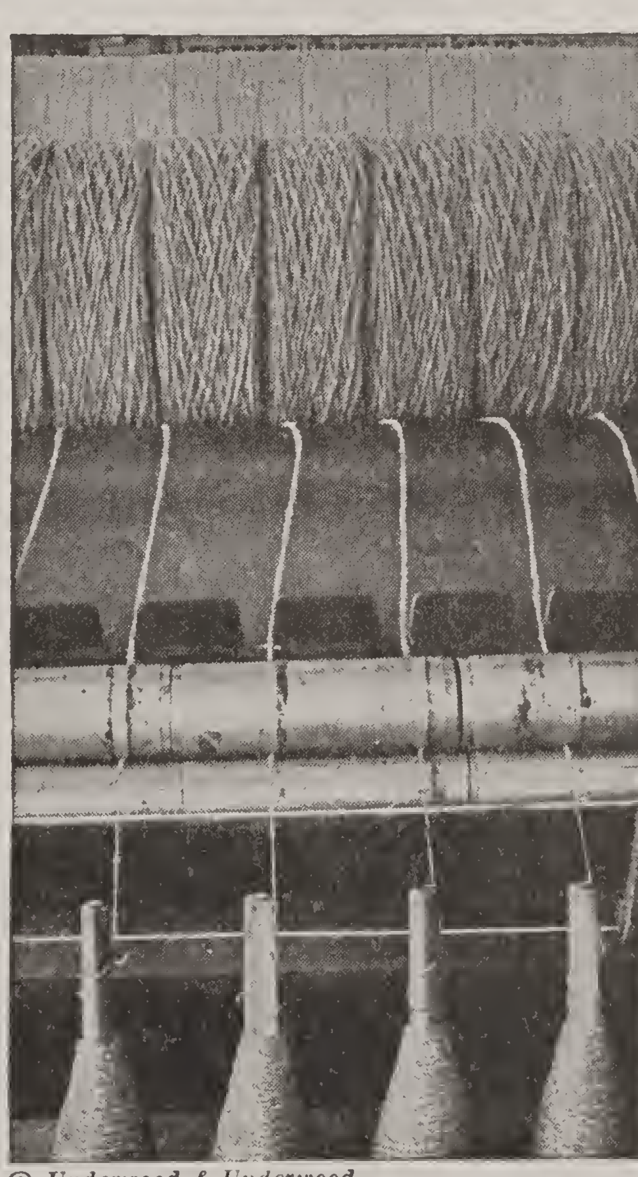
Next the yarn is twisted into tough, strong threads.



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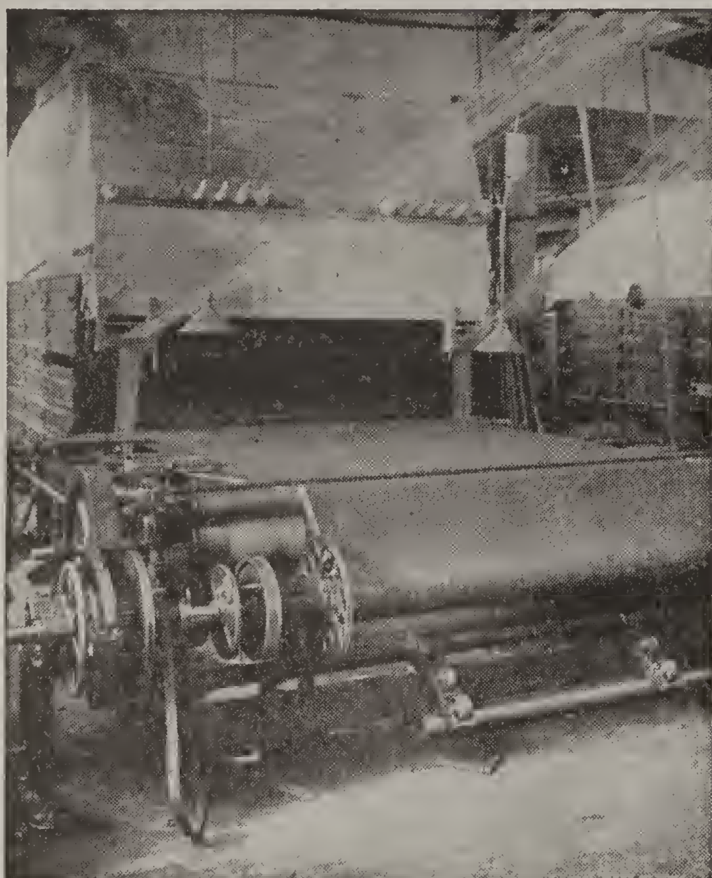
A close view of the spinning machine shows you how the work looks at this stage. It is really more like thread than yarn.

Weaving the Cloth



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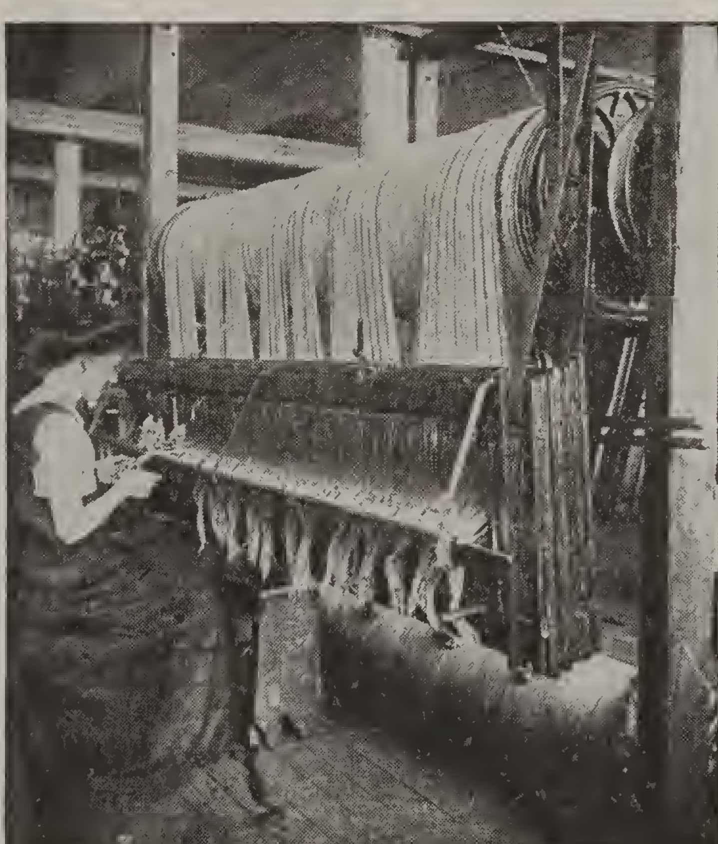
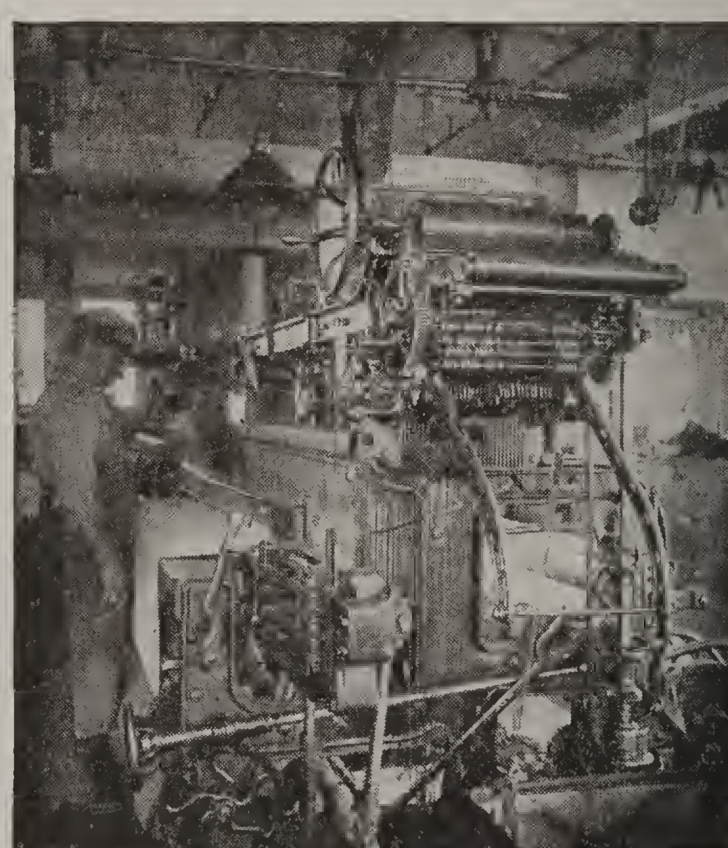
At the left the yarn is being sized in the machine called a "slasher." It wets the threads with sizing to make them smooth and quickly dries them again.

To the right is the warping machine for arranging just the right number of threads, all parallel, on a roller together. They will be the warp threads of the cloth. Of course the number and their distance apart varies with the kind of cloth to be made.





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The girl at the left is preparing the warp threads of wool for the particular kind of cloth to be woven. The process is called "drawing in."

At the right you see a modern weaving machine. With all its complicated wheels, levers and rollers, it is only a development of the hand looms of our grandmothers.

"Dressing Up" the Woven Wool

© Underwood & Underwood

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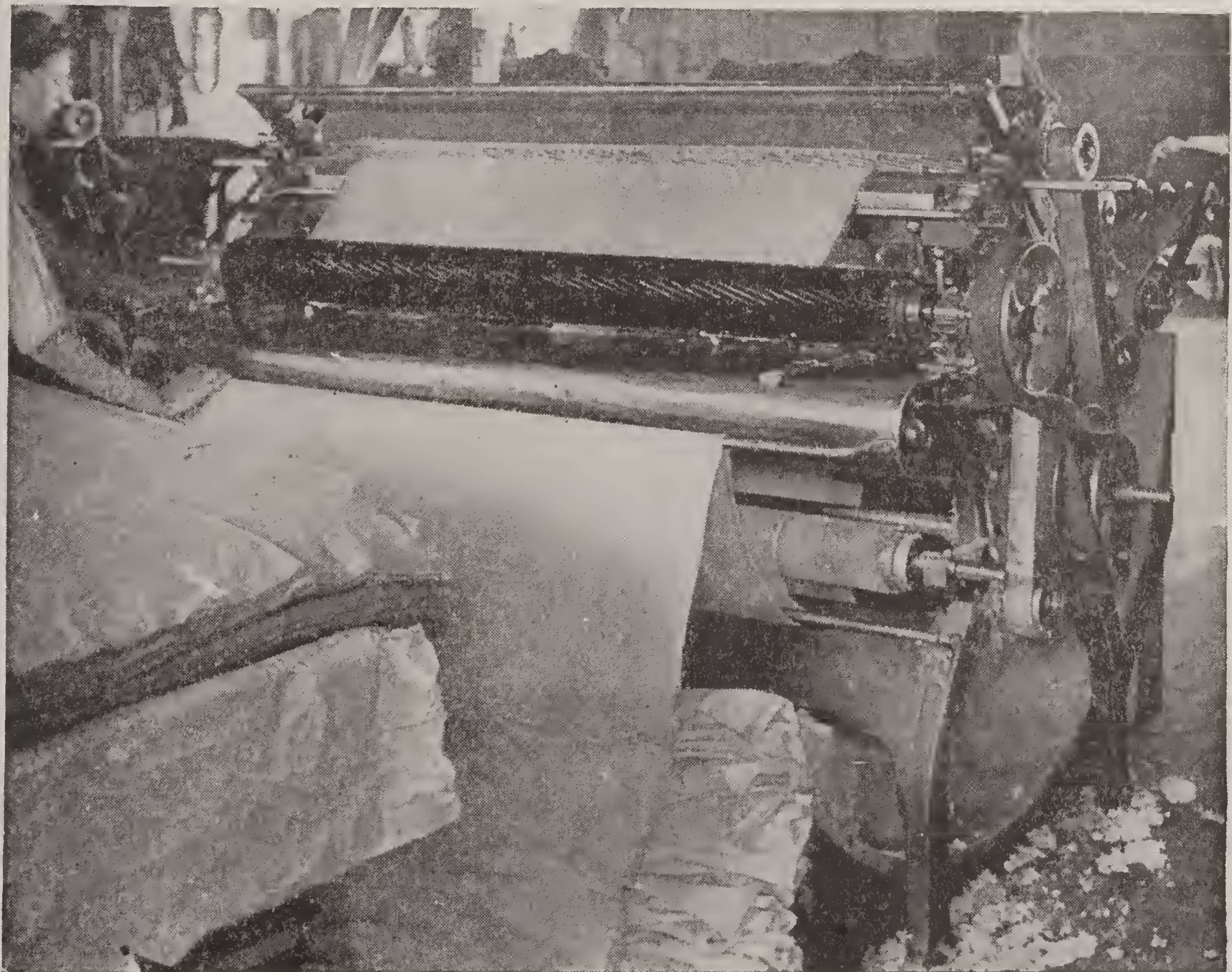
The man at the left is running woolen cloth through the teaseling machine which raises a nap on it by means of thistles. "By their stems they are set in rows of holes around a cylinder. This is revolved just above a traveling belt of cloth, and a soft fuzz is pulled up all over the surface."

At the right the man is "fulling" the woolen cloth by wetting it. Later it will be heated, then pressed. All these processes give the cloth the close-woven, soft, lustrous finish we admire so much in woolen goods.



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This is the machine that shears the nap from the cloth. The rods and rollers at the bottom of the machine, over and between which the cloth must pass, serve to make the tension even, to hold the cloth in place, smooth but not too tight. The dark roller at the top has a series of revolving knife blades that pass over the cloth, shearing it of nap as a lawn mower cuts the grass.

indigo and saffron. Their knitting needles twinkled in the fire and candle light. When they bought a piece of merino for a Sunday gown they made sure it was all wool.

How to Test Woolen Goods

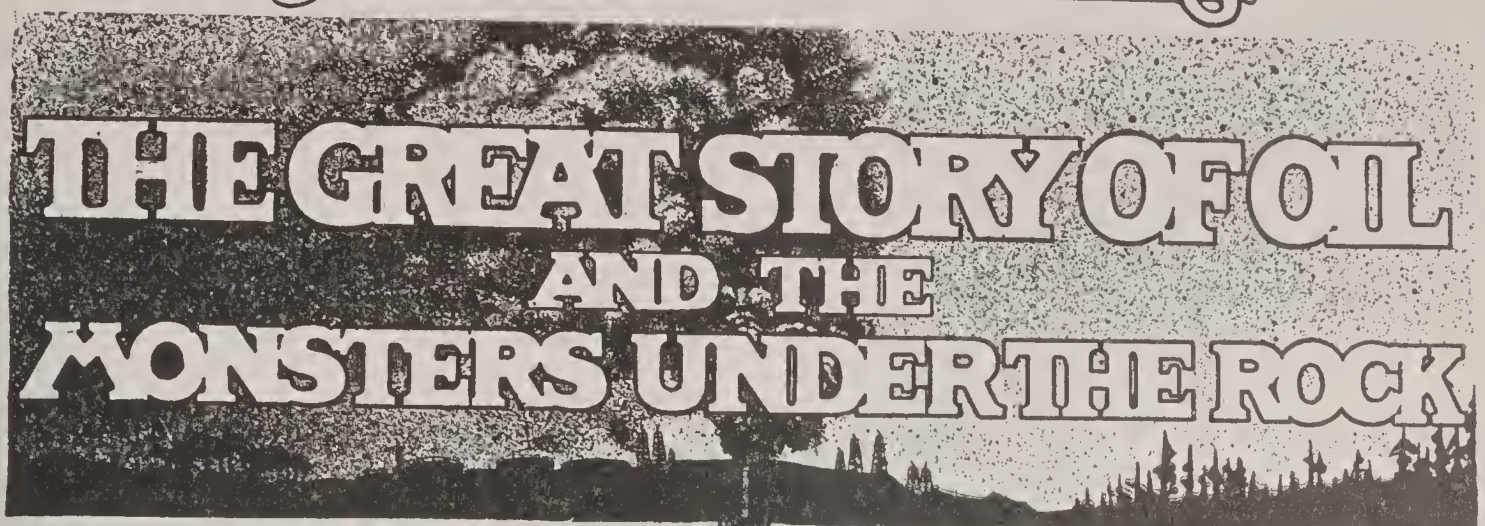
Get a lot of samples of cloth you think are wool and test them. It's fun for a family or a class in school. Sprinkle the samples with water. Water soaks into cotton at once, but it stands up on wool in beads. A cotton thread feels smooth and it breaks with a snap. Wool threads are rough and elastic. They stretch and part, leaving ragged ends. Cotton chars, like paper or wood when it is burned. It is a woody fibre. Wool "curls up and dies," as if in pain, and has a bad smell, like burning hair. It is an animal fibre. Some goods are a mixture of cotton and wool. That is all right for many purposes. But you shouldn't pay as much for it as for pure woolen cloth.

Ask grandmother what people mean when they say that a thing or person is "all wool and a yard wide."

The Sheepfold

Shepherds all, and maidens fair,
Fold your flocks up, for the air
'Gins to thicken, and the sun
Already his great course hath run.
See the dew drops how they kiss
Every little flower that is;
Hanging on their velvet heads,
Like a rope of crystal beads,
See the heavy clouds low falling,
And bright Hesperus down calling
The dead night from under ground;
At whose rising mists unsound,
Damps and vapors fly apace,
Hovering o'er the wanton face
Of these pastures, where they come,
Striking dead both bud and bloom:
Therefore, from such danger, lock
Every one his loved flock;
And let your dogs lie loose without,
Lest the wolf come as a scout
From the mountain, and, ere day,
Bear a lamb or kid away;
Or the crafty thievish fox
Break upon your simple flocks.
To secure your selves from these,
Be not too secure in ease;
Let one eye his watches keep,
While the other eye doth sleep;
So you shall good shepherds prove.

—Beaumont and Fletcher



ARE you reading this story by the light of an oil lamp? When Lincoln was your age he had to lie on his stomach before the fireplace, to get enough light to read by. In 1860, when he was elected President, most people were still using candles. No wonder it was "early to bed" in those days. Now, in every corner of the world, little white, black, brown, red and yellow children study their lessons and play games by the soft, clear glow of the kerosene lamp.

When Lincoln Was a Boy

When Aladdin rubbed his magic lamp you know what happened. One of the genii popped up, and there he was, right in the middle of a made-up story. Let's rub our lamps and jump into a more wonderful, really truly story.

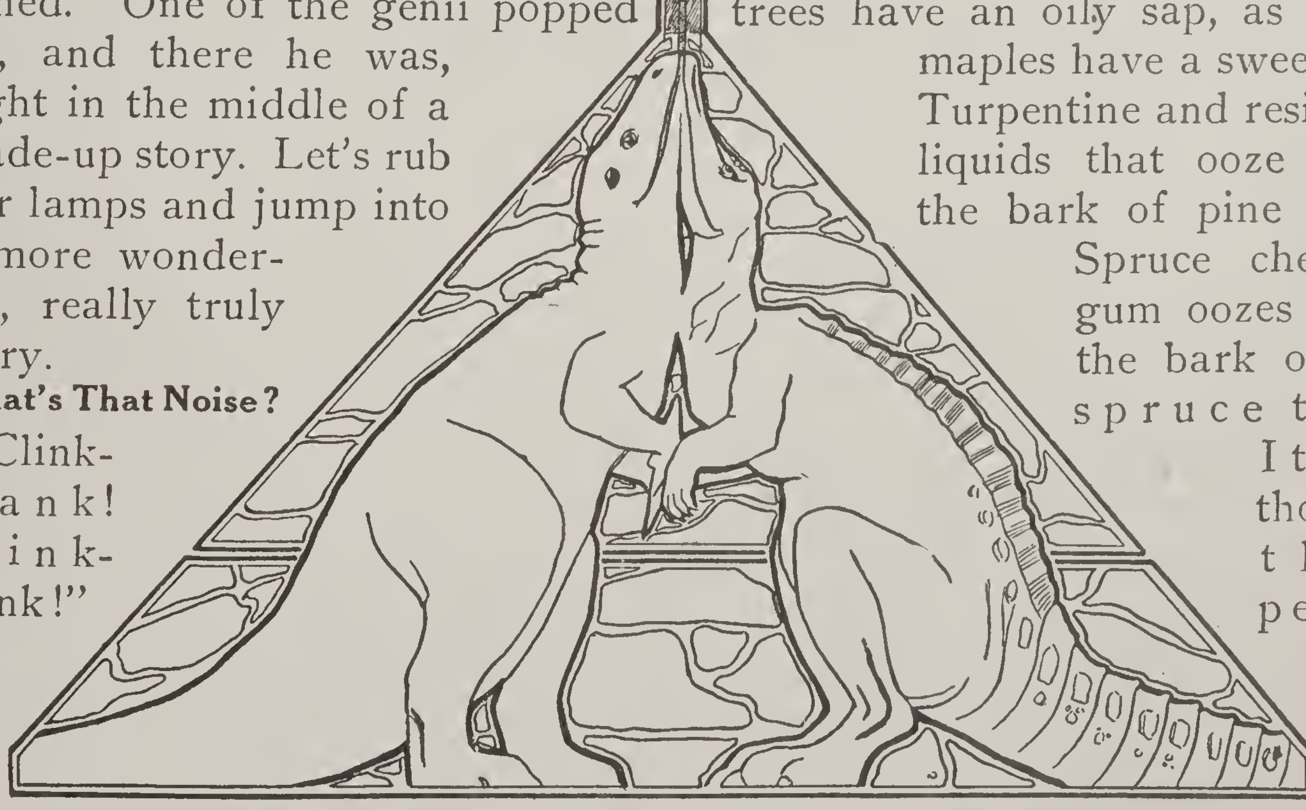
What's That Noise?

"Clink-clank! Clink-clank!"

It sounds like the fairy hammers of the genii on the walls of deep wells. That's what it is—men hammering holes in the earth to find its "oil barrels." Kerosene is made from petroleum, or "rock oil." Like gold, this pale yellow oil is found far down, in the rock layers of the earth. Men drill for it, as they drill for artesian water.

But it is not a mineral. You know coal is plants pressed into solid blocks. Nuts and olives and cotton seeds and castor beans and many other fruits have oil in them. Cone bearing trees have an oily sap, as sugar maples have a sweet sap. Turpentine and resin are liquids that ooze from the bark of pine trees. Spruce chewing gum oozes from the bark of the spruce tree. It is thought that petro-

How Oil Grew in the Woods



leum is the sap of such plants. Some of it may be the fat of sea animals that soaked into the sandy bottoms of ancient oceans. See how much kerosene will soak into a bottle of dry sand. In some way great quantities of oil were pressed into spongy rocks. Then the oil rocks were

Oil Genii in their Dungeons

In the Woods that Gave Us Oil

Imagine yourself in this forest—at a safe distance from that queer animal. He is one of those monsters that is supposed to have turned into kerosene oil. And it was such woods as these that are supposed to have contributed their oily sap.

roofed over with hard slate-like rocks. So the oil was held prisoner in underground dungeons for ages. About fifty years ago a giant key unlocked great treasure chests of golden light.

How the Oil Genii "Called for Help"

Men thought there was oil in old mother earth's secret strong rooms. Through cracks in that slate roof, the oil broke prison and came to the surface. It stood in beads on spring water. It spread a black, ill-smelling scum on creeks and ponds. Salt springs sometimes spouted a thick, oily brine. It filled some hollows and slowly dried to— You want to find out for yourself, don't you? In western Pennsylvania there was land that was just soaked with oil. You can find Oil City between Pittsburgh and Buffalo. Many pioneers who built cabins on Oil Creek moved away. Horses and cows could not drink the oily water. Oil was needed so badly for lamps that a well was drilled there. Tons of tools and supplies were hauled through seventy-five miles of woods. A derrick, or skeleton tower of timbers, was set up. Under that two men drove fifty feet of hollow iron cylinders

Where the Map was Soaked with Oil

down to bed rock. Black bears and wild cats and deer were in those woods. What do you suppose they thought of those queer doings?

Driving the Key into the Genii's Dungeons

Into the iron-walled well, a "string" of tools was dropped. On one end was a huge auger, or cutting bit, of steel. An iron sinker bar was on the other. They were connected by iron links. The "string" was looped to a rope that passed over a pulley wheel at the top of the derrick. The "string" of tools was sixty feet long. It weighed a ton. The auger cut through the rock, the bar crushed it to sand.

A $40,000 Journey and Nobody at Home!

Forty times a minute bit and bar rose and fell. Sand and water had to be bailed out. Broken tools had to be "fished" out. One man was kept busy sharpening augers. All oil wells are drilled in this way. Drills may go down two thousand feet, and the hole-in-the ground cost $40,000, without finding oil. A well may be a "duster" or dry hole, a pumping well or a "gusher." A "gusher" might be called a geyser.

A Roaring Column of Oil

"Clink-clank! clink-clank!" goes the drill, one minute. The next a

Then Out Rushed the Oil Giant

ton-weight "string" is hurled out and shot high above the derrick by a roaring column of petroleum.

Can't You Hear these Gushers Roar?

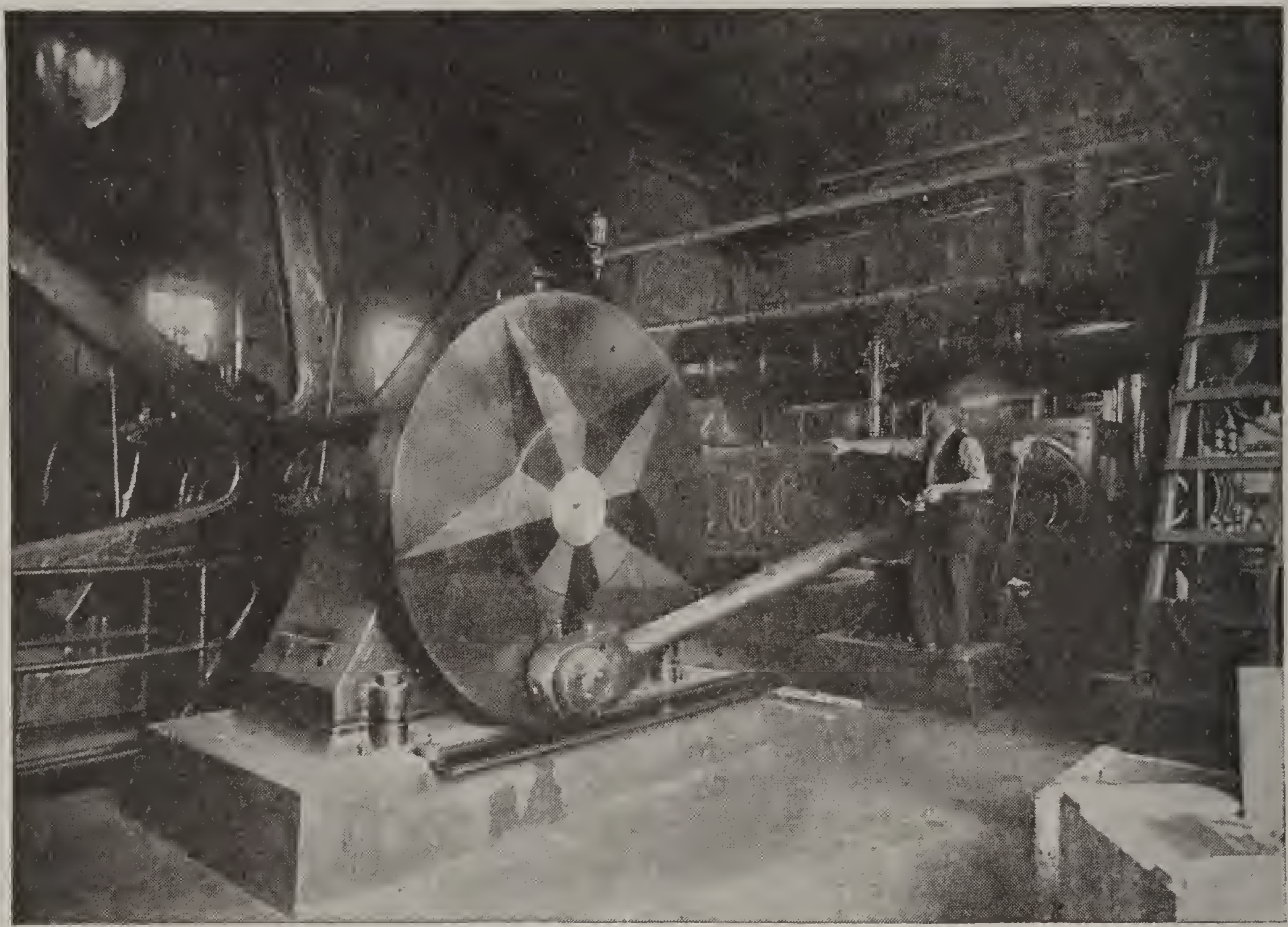
Here are some oil wells which have just been "shot" with nitroglycerine. Can't you fairly hear the "roaring column" as it shoots high above the derrick just as it is described as doing in our story?

The first well on Oil Creek was a pumping well. At sixty-nine feet in bed rock, the drill sank into the oil sand stone. The well filled with petroleum over night. The news spread like wild fire.

"Struck oil on Oil Creek!"

There was as much excitement as when gold was found in California. Oil City was like a mining camp town. Pioneer farmers were millionaires over night. A ten mile

One of the Great Pumps



This picture shows one of the great pumps by which the oil is sent through pipes underground. Its work is like the little pump in your own body which sends the blood through your "underground" pipes. This pump handles 60,000,000 gallons every twenty-four hours. Notice the words "S. O. Co." near the governor of the engine. "The Standard" is the largest oil company in the world.

forest of derricks sprang up along Oil Creek. Drills went deeper, through three slate roofs. A "gusher" was struck five hundred feet down, in the third layer of sand stone. When oil was found men did not know what to do with it. Handling petroleum was a new business. They had to learn how to store it, ship it and refine it. As it came from the earth petroleum was good for nothing. It was a thick, dark, gummy, vile-smelling fluid. It was smoky and exploded easily.

A Troublesome Fortune to Hold

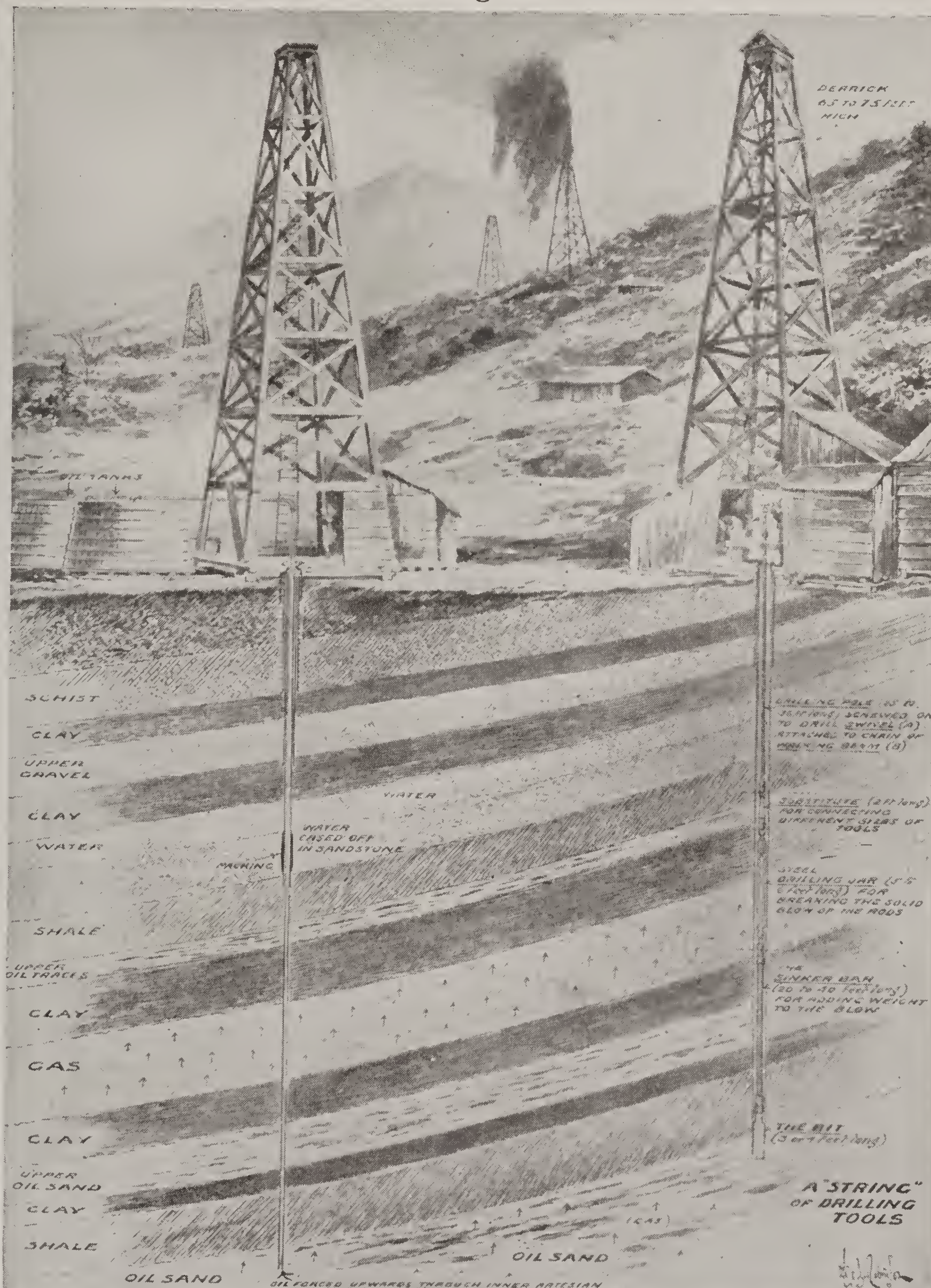
The Oil River System Under Your Map

It was pumped into barrels first, then into tanks on flat boats. Someone thought of pumping it to market, through iron pipes. Wasn't that a bright idea? Now there is an underground "river system" of hollow iron pipes that carries nothing but oil. It starts in Texas. It runs north through Kansas. It tunnels under the Mississippi River and crosses Illinois, Indiana, Ohio Pennsylvania and New Jersey. Branch pipe-lines run out to the oil fields along the way. Every thirty or more miles there is a pumping station, with storage tanks.

Steam "Heart Throbs" That Pump Oil

A steam pump forces the oil through the pipes, under rivers and over mountains. Whirligigs of blades called "go-devils" are carried along to keep the pipes scraped clean. A

How Oil is Brought to the Surface



Here the artist has summed up the story of where oil is found and how it is brought to the surface. A curious thing about it is that the oil furnishes its own power for being raised to the surface. This power comes from the gas which the oil itself gives off. Notice at the bottom in the section marked "Oil Sand" how the gas is forcing the oil up through the pipe to the tanks above, as indicated by the arrows.

A "Tank Farm"

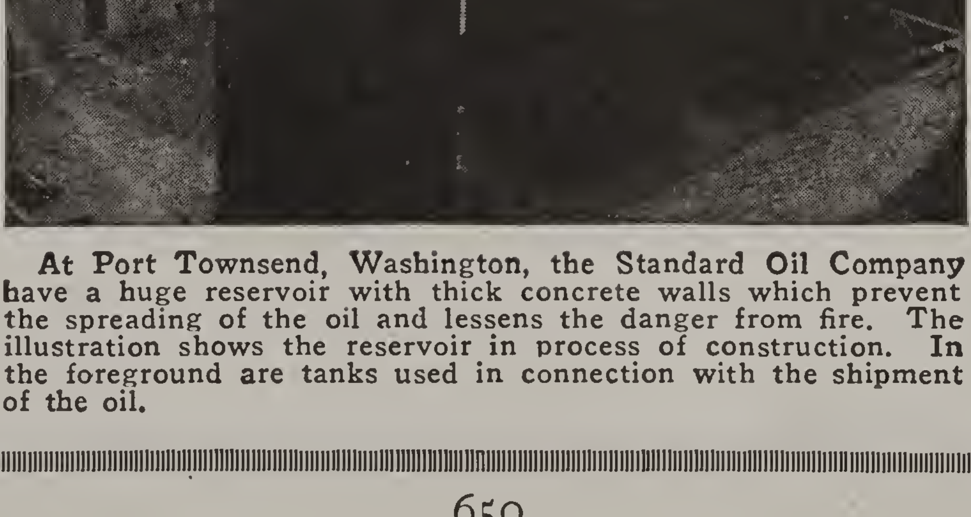
This is a scene in the oil fields of Kansas and is called a "Tank Farm." You can see why—it's on a farm where they "raise" oil. This farm is near Neosha. Each of those tanks holds 35,000 barrels of oil. Figure out from the number of tanks how much oil there is stored here when all these tanks are full.

well owner stores his oil in huge iron tanks, as a farmer stores wheat in an elevator. When he sells his oil he opens a faucet and lets it flow into his branch pipe-line. At the refinery, on some sea or lake port, or railroad center, another faucet lets a stream of oil into a six hundred barrel tank.

To properly understand refining, you must know what petroleum is. You know that water may be in the form of a vapor, a liquid or a solid. It is sometimes steam, sometimes ice. Petroleum is one form of bitumen. There is a solid bitumen and a vapor bitumen. Haven't you seen men spread asphalt on a street? It is hot and soft. It smokes and smells like roofing tar. When cold it hardens. Asphalt is a solid bitumen. It is petroleum that came to the surface and dried out.

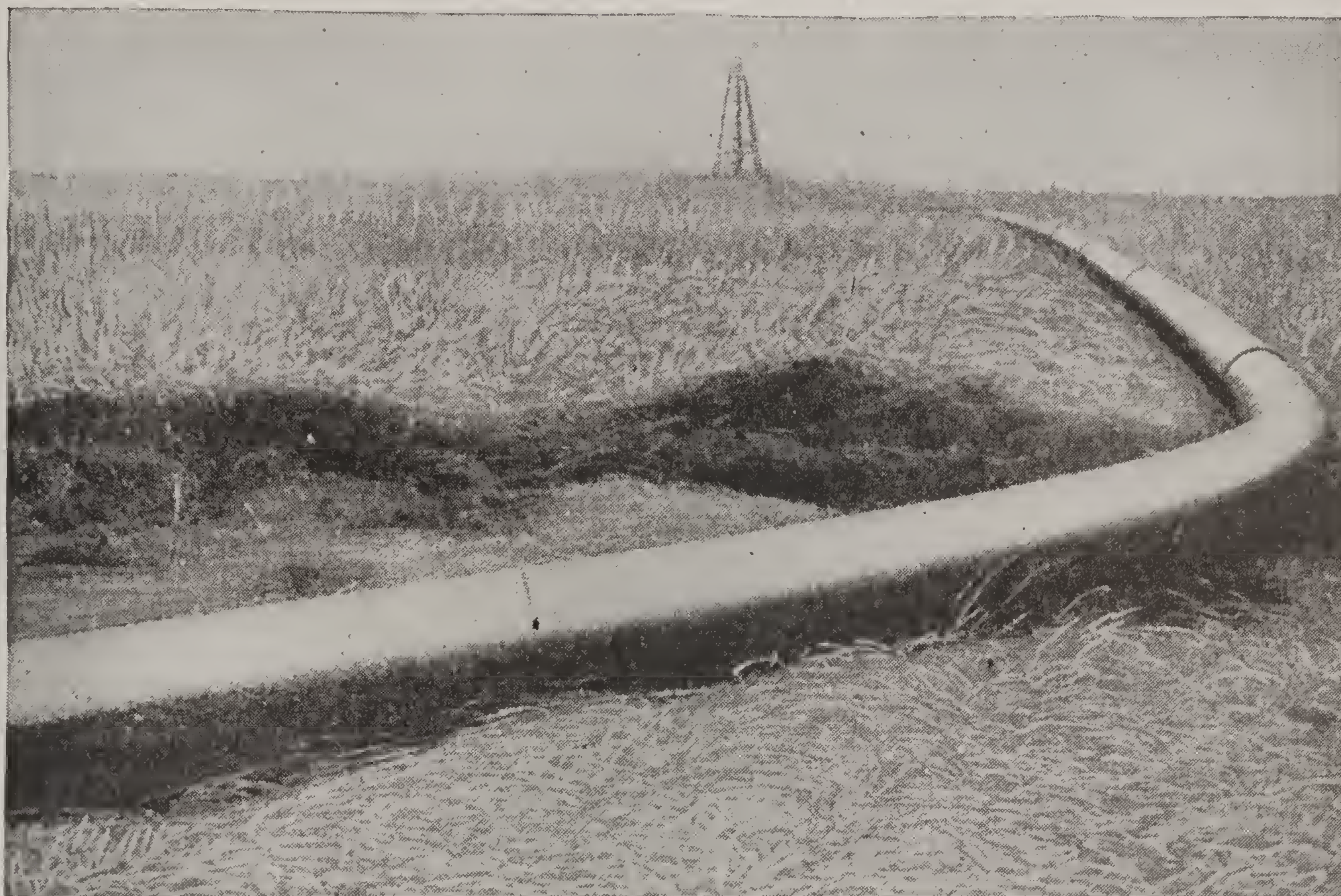
Next to the asphalt is "mineral" pitch, a thick, oily paste, on the way to drying to asphalt. The third bitumen is petroleum, or rock oil. The fourth is a thin, clear, gas-like liquid called naphtha. And then comes natural gas. All these are found separately in the earth. Petroleum has the middle place among the bitumens. It is the mother of gas, naphtha, pitch and asphalt, as water is the mother of vapor and ice. All

Building a Mammoth Tank



At Port Townsend, Washington, the Standard Oil Company have a huge reservoir with thick concrete walls which prevent the spreading of the oil and lessens the danger from fire. The illustration shows the reservoir in process of construction. In the foreground are tanks used in connection with the shipment of the oil.

One of the Pipe Lines

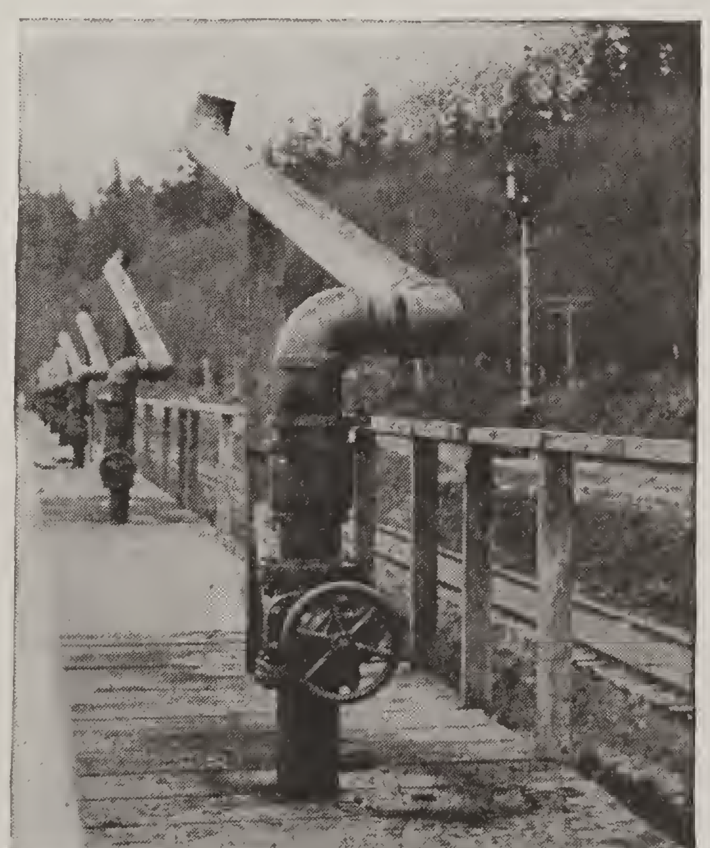


Here is where one of the great pipe lines into which that huge pump sends the oil, is running above the ground across an oil field. Notice the derrick in the distance.

the other forms of bitumen are in petroleum and can be separated from it. And it is as simple as turning water into steam.

Many things beside water can be boiled, even gold and iron. Metals like very hot fires. Oils boil or give off vapor with less than half the heat needed by water. Gasoline, one of the naphthas, evaporates quickly just in warm air. Kerosene, if heated to 110 degrees, gives off a gas vapor that can be lighted with a match. Machine oil takes more heat to vaporize. There are still heavier oils, waxes and gums in petroleum.

Shall I Stop Here?



Here is a railway distributing station on the underground oil railroad. By a turn of the wheel the flow of oil is stopped or sent on in the proper direction.

The big tank of petroleum in the refinery is warmed by steam coils. Soon the naphtha in it boils and passes off, in vapor, into pipes kept cold by icy water baths. There the vapor turns into a liquid, as steam condenses on a cold window. When the naphtha stops coming the heat in the tank is increased.

Loading Tank Steamers with Oil

© Keystone View Co.

This is a fine view of a "tank steamer" at Port Arthur, Texas, being filled with oil. These pipes are a part of the great pipe system which connects the oil refineries. One of the tanks of the steamer is being filled by means of the large hose in front of the man. One end of the hose is attached to these pipes and the other end discharges the oil into the tank. Port Arthur is near the Gulf of Mexico, about thirty miles southeast of Beaumont, Texas. Two of the largest oil refineries in the world are located here and give employment to a large percentage of the population.

Then the kerosene vaporizes. The heat gradually rising, machine oils are separated, then vaseline, axle grease and wax. The wax is paraffin. What is left in the tank is pitch and asphalt. These can be separated, too, leaving pure carbon or coke. Out of that electric light carbons are made, and crayons for drawing.

Two Hundred Things That Came With the Oil Light

In drilling for petroleum, men wanted lamp oil. They got it, but they got a great number of other useful things with it—nearly two hundred of them. Every family uses kerosene, gasoline, vaseline, machine oil and paraffin wax. All these things have to be purified and tested. If any naphtha is left in kerosene, it may explode when put in a lamp. Sulphur makes a lamp smell badly. Acid and carbon specks make lamps smoke. Kerosene has to be washed in soda water and filtered. The soda eats the acid out.

The Kerosene and the Soda Water

King Kerosene the "Globe Trotter"

Crude oil goes to refineries by pipe lines. But kerosene is shipped in iron tanks, mounted on flat cars. You see them on every railroad. Tank wagons take the oil to store keepers. From the very first we had oil to sell in other countries. And for twenty years we had all the oil that had been found. It was shipped in barrels in sailing vessels. Steamers were afraid to carry it. Oil and fire were rather dangerous neighbors on the ocean. Now it is safe. The oil is pumped into fire-proof iron tanks in the holds. From foreign seaports oil is sent on in tank cars.

How the Oil is Shipped Abroad

In parts of the world where there are no railroads, kerosene is sent on

An Interesting Chapter in the Story of Oil

In the far away East Indies where modern methods of transportation have not yet come into use, oil rides on the backs of strong brown men who march in long lines with their loads. They are carrying the oil from the ship to warehouses.

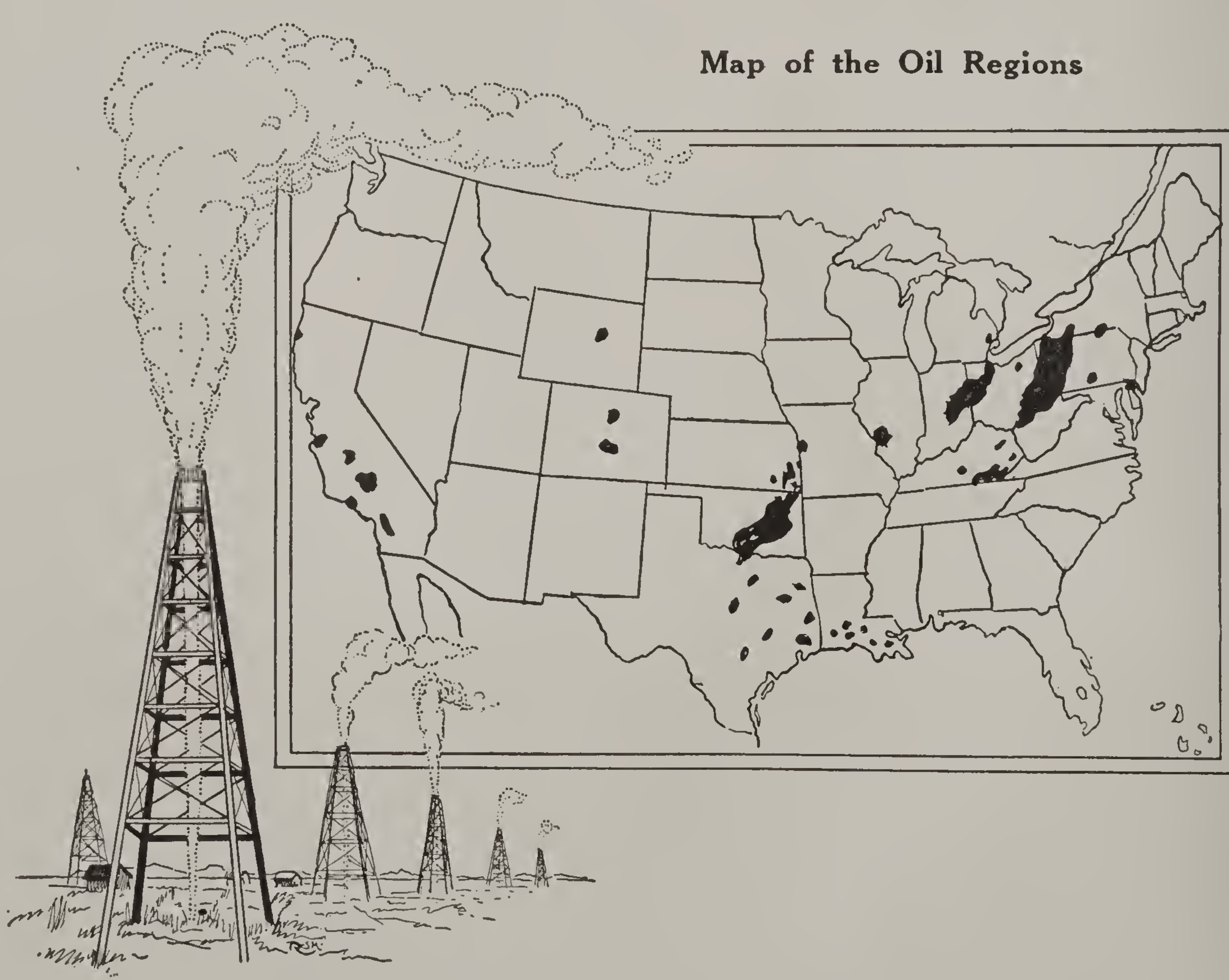
Transporting Oil in the Orient

Here we see camels loaded with oil ready to start across the desert. The natives in eastern countries value highly the tin cans when empty. They make them into various domestic utensils, such as cooking vessels and lamps, and use them for roofing small houses.

This Oil Reservoir Holds

Here you see, being built, an enormous concrete reservoir for holding oil. It is on a tank farm near San Luis
ladder, the steel rods around which the concrete is molded in its soft state. The concrete walls, bridges, viaducts
It is just like the ancient cliff dwellers using sticks to help hold their mud floors together on the "front porch,"

Map of the Oil Regions



a Hundred Million Barrels

bispo, California. It is now completed and has a capacity of 100,000,000 barrels. Notice, on the right near the
d other engineering works so built are called "reinforced" concrete.
shown in the picture in the story of our National Parks.

in many curious ways. It is put into tin cans that hold two or five gallons. Native sailboats carry cargoes of oil in these cases up countless rivers into the heart of China, India, Africa and South America. Where the boats stop, the cases are loaded on pack animals. Camels carry them across deserts; elephants over mountains; burros to Mexican mines; water buffaloes to Philippine plantations. Patient donkeys draw oil tank carts for peddlers. Men wheel the tanks on push carts and barrows. No country is too distant, no people so poor that they cannot have American kerosene.

Now Into Native Sail Boats

The great Standard Oil Company has an army of agents scattered all over the world. Each agent is a soldier with officers over him. He is

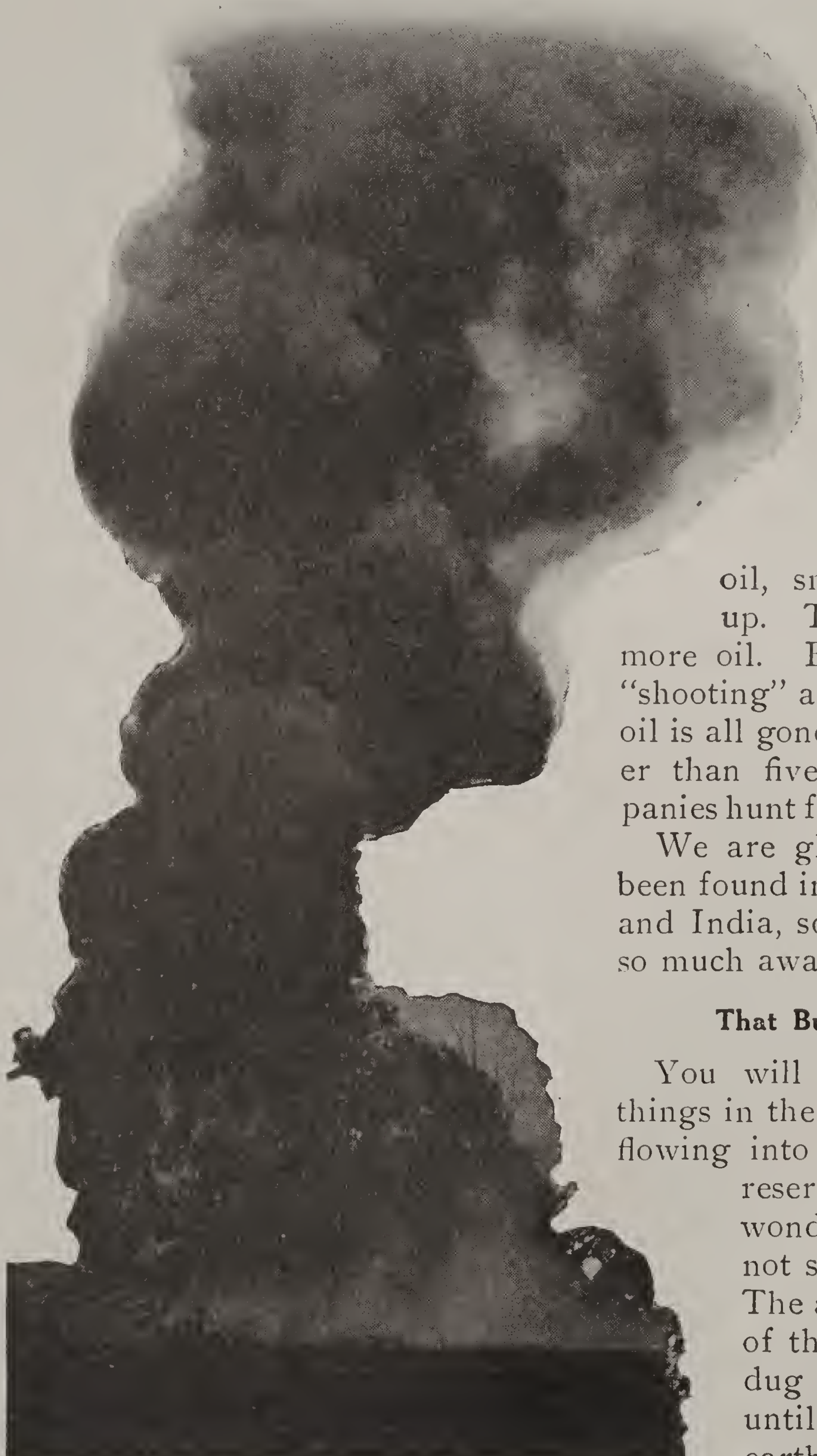
The Army of Salesmen

Six Acres of Oil

These workmen are putting a roof over the million barrel concrete oil tank which covers six acres at San Luis Obispo, California.

told to open new trade routes. He must show ignorant people how to use and care for lamps. For some very poor people in China and the sea islands a good, cheap lamp had to be made, and sold below cost. Governments have had to be asked not to tax the oil, so that the poor could buy it.

A Volcano Made by Man



When an oil well catches on fire it looks like a volcano and may burn for days. The country round about is covered with heavy black smoke and soot.

Part of the oil trade is being taken from us by Russia. Some people think it would be a good thing if we sold still less. You see every oil well, and even whole oil fields, go dry. A "gusher" dies soon, like a geyser, and has to be pumped. When the pumps fail, a giant torpedo is put into the well and exploded, to break up the oil sand stone. After an earthquake shock, a column of oil, smoke and rocks shoots up. The pumps can then get more oil. But a time comes when "shooting" a well does no good. The oil is all gone. Few wells flow longer than five years. The oil companies hunt for new fields all the time.

We are glad that oil fields have been found in Russia, Austria, Japan and India, so that we need not send so much away to other countries.

That Bubbling Lake of Oil

You will find many interesting things in the picture of the crude oil flowing into the temporary earthen reservoir. No doubt you wonder why the oil would not seep back into the earth. The answer is that where one of these big pits is properly dug the soil is scraped away until comparatively solid earth is reached, and then this earth is beaten, or tamped, as hard as possible,

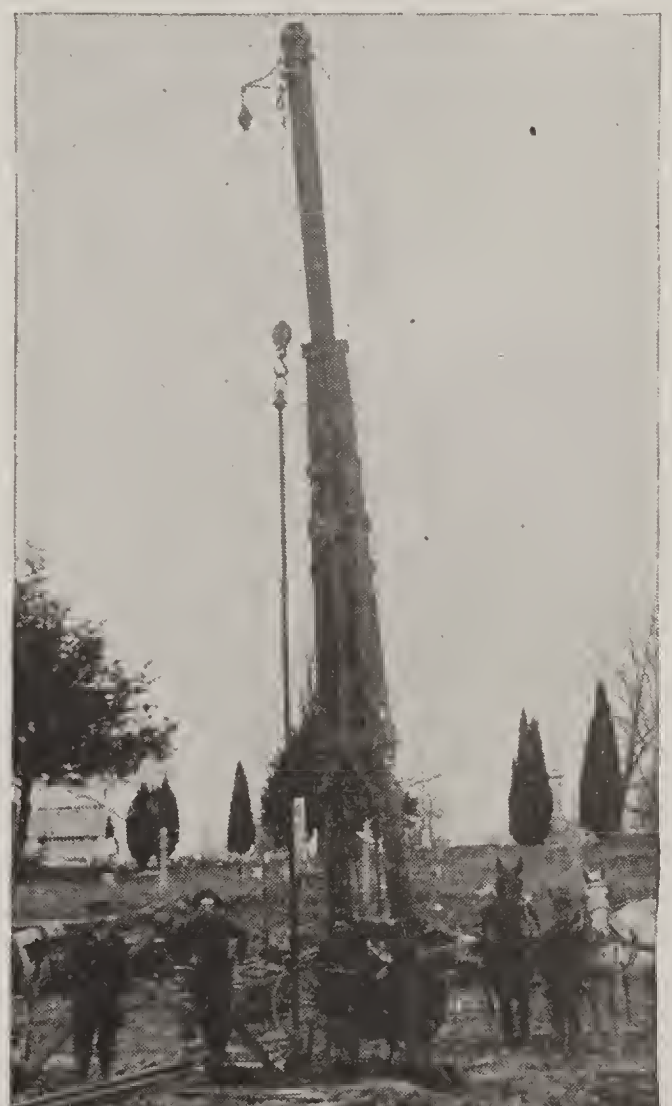
A Big Lake of Oil

Crude oil is here being pumped into an earthen reservoir at Muskogee, Oklahoma, through that big pipe on the left. The reservoir is just a big pit scraped out of the ground as you see men doing when they are digging out the foundation of a big building.

much as they used to tamp down the earthen floors of log cabins. After this is done the oil seldom soaks in more than five or six inches.

Now, what do you suppose those two dark masses in the center of the picture are? They look like brush or rubbish of some sort, don't they? As a matter of fact, all the rubbish and loose dirt is scraped away, and what you see there is simply the crude, black oil being forced up into the air by the pressure of oil and gas

Pulling Out a Casing



This is the tube or casing of an oil well. The well is dry now, so the casing is being pulled out to be used again somewhere else.

which is coming in through that great pipe. The end of the pipe itself is probably just about under those black spots in the picture.

In the background of this "lake of oil" you notice there is a line which looks as though it might be a temporary dam or dike. This is simply more oil bubbling up from various feed pipes which are coming into the reservoir from different sides.

Oil reservoirs of this kind are only used for temporary storage and are

Letting Down the Loaded Shell

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This is a scene in the oil fields in Pennsylvania. It shows a workman letting down into an oil well a shell loaded with nitroglycerine. The shell is exploded at just the point where it is necessary to break up the strata in order to make the oil flow. The shell must be lowered with care on this account. In order to do this the "shooter," as he is called, fastens his reel by clamps to the fly-wheel of the engine used in drilling the well. On this reel is wound a thin but strong manila rope about 2,000 feet long. When the engine is started the shells are lowered, one at a time, into the well. After each shell is lowered the measuring steel tape is let down to determine whether the shell is at the proper depth. With his left hand the shooter is holding the brake of the wheel to stop instantly, if necessary, the descent of the shell.

usually constructed only when a big, new supply of oil has been discovered, or where it is necessary to get additional storage quickly because the oil is flowing out so fast.

Of course you know those tall figures in the background are oil derricks.

Will We Miss the Oil When the Wells Run Dry?

A dry water well is filled again by rains. A cut-over forest can be replanted, but when our oil is gone it will be gone forever. Perhaps, then, we shall all have gas or electric lights. But these need expensive pipes and wires. There may never be another source of light found as cheap as oil and as easily carried wherever boats and animals and men can make their way.

Helping People See to Think

Some people think petroleum the greatest discovery of the century. It has lifted millions of people out of the darkness of night and mind. Working every moment of daylight, the poorest people could not even learn to read. After toil they sat in dreary darkness, unable to see to do anything.

Rub your kerosene lamp. It is more wonderful than Aladdin's! Can't you see happy family groups, of white and black, red and yellow and brown people? Father is reading, mother writing a letter, children playing games and studying lessons in countless, softly lighted rooms.

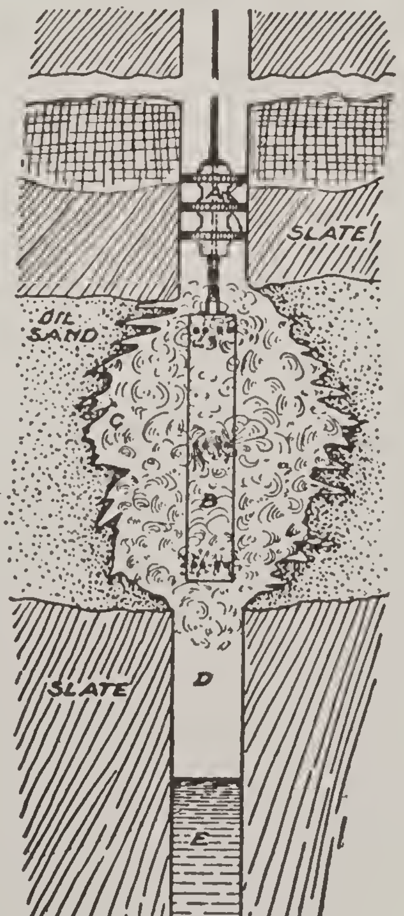
Bravo! Good oil genii of the magic lamp!

"Jack Squib" Loaded with Dynamite Ready to Drop Into the Well

© *Keystone View Co.*

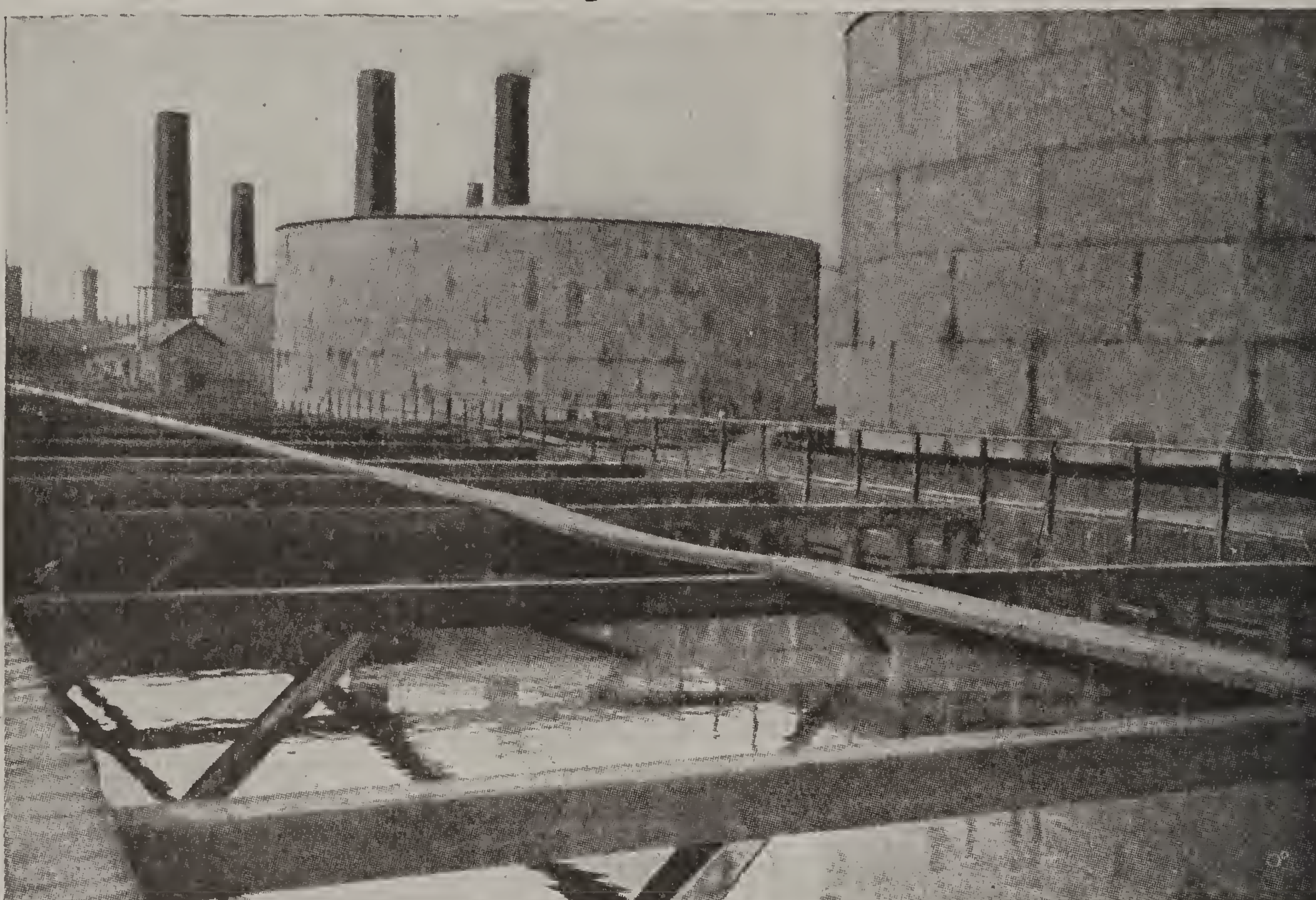
The workman is here holding up what is called the "Jack Squib," so that you may have a good look at it before he drops it into the well. The "Jack Squib" contains the dynamite. It is a tin pipe closed at the pointed end and filled to the depth of several inches with sand or dirt. Imbedded in this sand is a stick of dynamite, in which are long powder fuses with fuse caps on the ends of them. Sand is packed around these fuses so that they will burn slowly and thus prevent an explosion before the dynamite reaches the proper spot. This man will light the fuses, drop the squib into the well and stay there until he hears an explosion. Then he will run to a safe distance.

When the Paraffin Makes Trouble



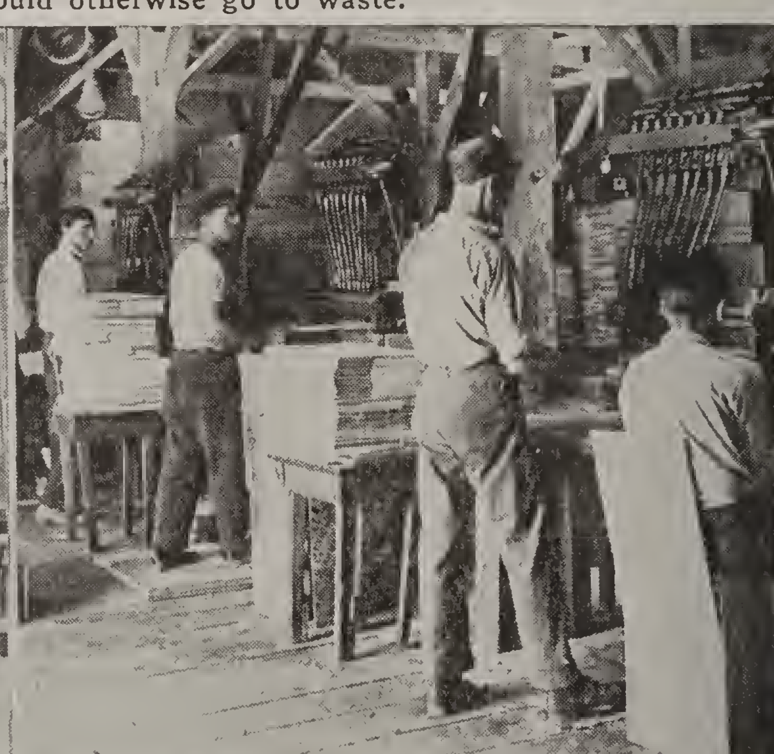
Here is a diagram of an oil well. The oil is in the layer of sand between the two layers of slate. It oozes and drips into the cavity, C, and down to the pocket, D, below. But paraffin wax is also present wherever petroleum is found. This wax collects on the edges of the cavity in the oil sand and corks up all the cracks so that the oil cannot come through. A steamer has been invented which removes the paraffin. It consists of a metal tube, in the upper part of which is a smaller tube, B, containing water, with small holes in the bottom through which the water is sprayed evenly into the larger tube. In the bottom of the larger tube are pieces of cast iron which have been heated white hot. The water from the smaller tube dropping on the hot iron is changed to steam, which, by expansion, is pushed upward and out through the holes in the larger tube with great force. This steam sprays the walls of the cavity and melts the paraffin, which runs down into the pocket, D. The steamer is drawn up and the pocket filled with boiling water to keep the paraffin melted. Another steamer is lowered into the cavity while the iron pieces of the first one are reheated. The water, E, is kept hot by lowering the part of the steamer containing the hot iron into it each time before drawing it up. This process is kept up for from five to eight hours, at the end of which time all the paraffin has been melted from the sand walls of the cavity and has run down into the boiling water, E, in the pocket. This water and paraffin is then pumped out and the oil again runs freely.

Good Housekeeping in "Big Business"



"Saving the Fat"

It is curious how much little homes are like big, modern industries. A good housewife lets nothing go to waste. In what are often called "the big businesses," the same thing is true. Here is an illustration of it. In the oil business, the water used in washing out the stills, the tanks of steamers and barges—in fact, everything that has had any oil in it—is run into great open tanks like this. Then, of course, you know what happens—the oil rises to the top and is run off just as mother skims the various kinds of oil in cooking and saves it to be used again. Ask her about different ways in which she saves things that would otherwise go to waste.



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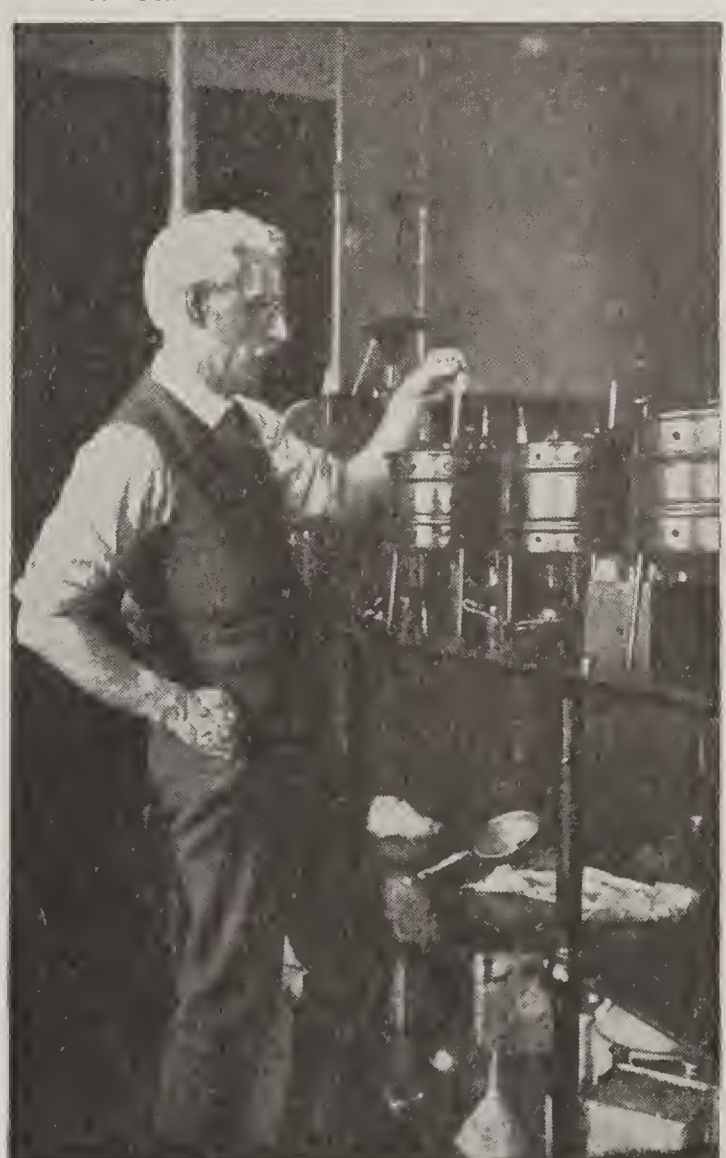
Another Form of Good Housekeeping in "Big Business"

As in other large industrial enterprises where "containers"—such things as boxes and cans for containing products—are used, the big oil companies make their own cans for holding kerosene and the boxes in which these cans are exported. The picture on the right shows the nailing machine, nailing boxes together. On the left is a conveyor which carries the boxes and the tin cans to the department in which the cans are filled and put into the boxes. The cans are placed on a platform which revolves, bringing them successively under faucets attached to the large galvanized tank seen in the background. Here the cans are filled just as the grocer fills our kerosene can.

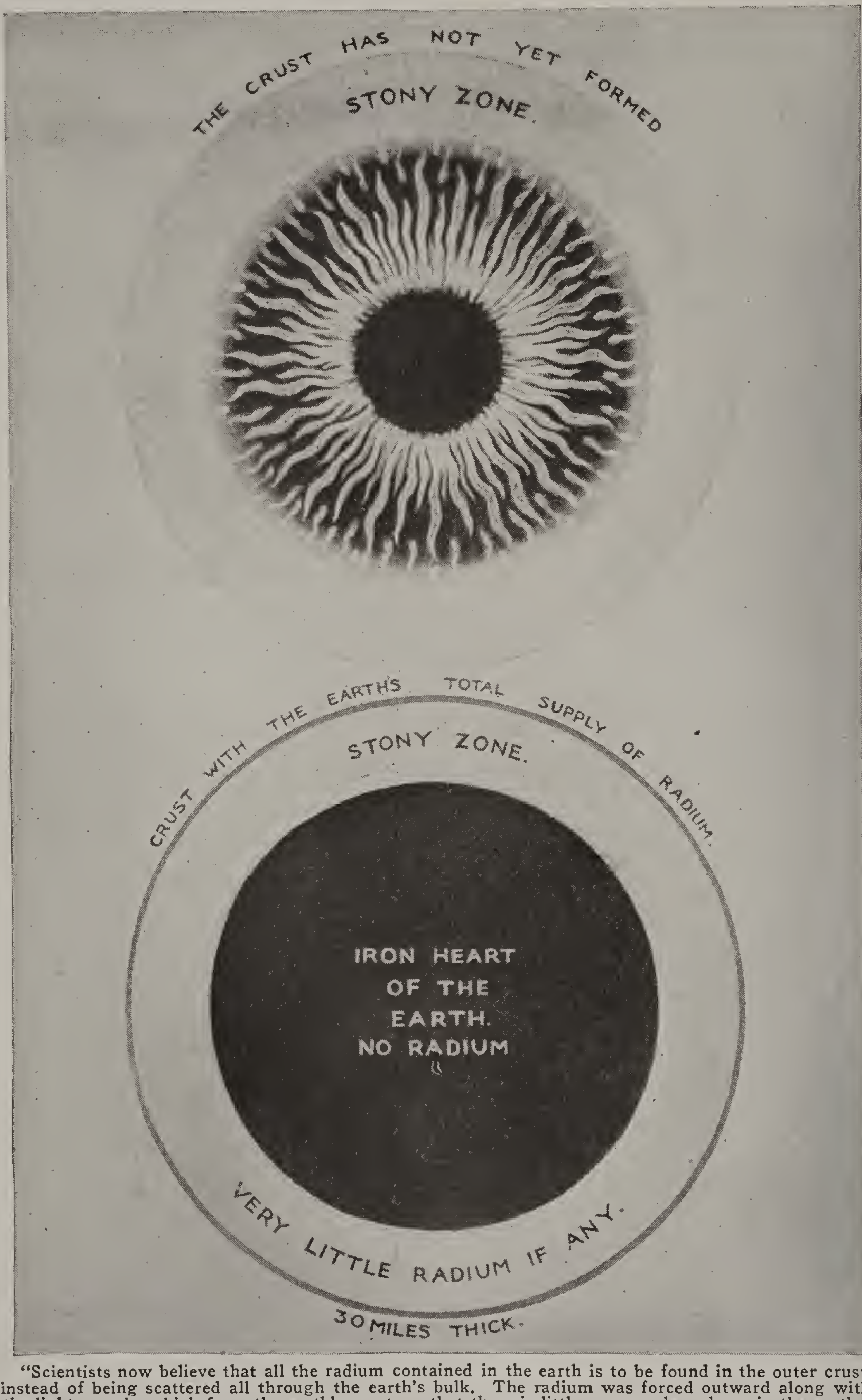
The Lamp Test

After that part of petroleum which is intended for the family lamp has been subjected to all the tests known to chemistry, it is given the final test of actual burning in various kinds of lamps. You know the old saying, "the proof of the pudding is in the chewing of the string."

Other Testers at Work



The "still man" (on the left) superintends the process of distilling the oil. He is here testing the product from different stills. The man on the right is testing the kind of oil used in machinery.



"Scientists now believe that all the radium contained in the earth is to be found in the outer crust, instead of being scattered all through the earth's bulk. The radium was forced outward along with the lighter rocks which form the earth's crust, so that there is little or none deep down in the earth."

Like a Little Sun

In one year one ounce of radium gives out as much heat as could be obtained by burning twenty pounds of coal.

What is Radium?

Source of Light and Heat That Is Worth Three Thousand Times as Much as Gold

YOU think a thing pretty valuable that is worth its weight in gold, don't you? Radium is a mineral that looks like pale yellow salt, but it is worth three thousand times as much as gold. It is called radium from a word meaning "light" because it gives off powerful heat and light rays that penetrate solid objects. Professor and Madame Curie discovered it when working with uranium ore in the physical laboratory of the University of Paris.

It has since been found in carnotite ore in Colorado and Utah. There are only two grains in a ton of the richest ore, and the process of separating it is costly.

"Sun" Grains That Shine Through Stone

As radium is always one and a half degrees warmer than the air around it, it is thought to explain the retention of heat by the earth and other heavenly bodies, especially as its rays go through solids.

There are three families of

The Flight of the Atoms

By means of a spinthariscope, the helium atoms can be actually seen flying off from a particle of radium, like the explosions of a bundle of firecrackers. The spinthariscope is a small instrument having a powerful magnifying lens and containing a disc covered with a film of zinc sulphide.

these rays, called Alpha, Beta and Gamma rays, from letters in the Greek alphabet. The Alpha family are helium atoms charged with positive electricity. They have not much penetrating power and can be stopped by a single sheet of paper. The second family of radium rays are negative electrons or parts of atoms, which can pass through some solids—glass and aluminum, for instance. The third set, the Gamma rays, have the greatest penetrating power of all. They are not electrified either positively or negatively and can pass through several inches of lead, water or iron.

Radium rays are used in photo-

The Radium Rock and Its Precious Prisoner

This is carnotite ore from Colorado. A ton of the very best of this ore yields only two grains of radium.

graphing hidden parts of the body, to locate bullets and injuries to bones and for the treatment of surface cancers. Wouldn't you like to know how they discovered the effect of the rays on the body?

How the Professor Was Burned

When Professor Becquerel of Paris, was experimenting with radium he carried a test tube containing it in his waistcoat pocket. Two weeks later a peculiar burn appeared on the skin beneath the pocket where the radium had been. Since then many experiments have been made and a big laboratory especially for the study of radium as a cure for disease has been built in Paris.

The "alchemists" of the Middle Ages tried to make gold out of other substances. Their methods were crude and unscientific and the majority of the men themselves were ignorant imposters claiming to be magicians. When people really began to study the elements of which the earth is composed they decided that there were a certain number of these elements and no more, and that they could not be changed or broken up. So they laughed at the poor old alchemists for thinking copper or carbon, for instance, could be changed into gold. But the discovery of radium has proved that one substance can change into another. It was found that uranium is constantly giving off particles or rays which contain radium and that radium, in turn, gives off thirty-four thousand million atoms of helium a second. In the same way thorium breaks up into other elements, and lead is now known to be formed from another metal. So the old

Dream of the Alchemists

alchemists were right after all in thinking that one element could be produced from another, although no one has ever learned how to change baser metals into gold.

Scientists now believe that all the radium contained in the earth is to be found in the outer crust and their reason for this is very interesting. Since radium and its "kinfolks" in the chemical world are constantly giving off heat, the earth must be getting hotter from year to year. If there was radium all through the earth's mass in the same quantity as at the surface (2 grains to a ton of rock), the heat produced would be 250 times greater than the quantity which the earth daily gets rid of in its ordinary cooling-off process, and our planet would gradually get hotter and hotter until some day it would burst into flames. But in the millions of years which have elapsed since the formation of the earth as a solid, enough heat would have been given off by the radium in it to produce this result several times over. Why didn't it happen? Because it is now thought there isn't as much radium in the world as was at first supposed. It is believed that instead of being scattered all through the earth's bulk, making the temperature at the center go up and up, the radium was forced outward along with the lighter rocks which form the earth's crust, so that there is little or none to be found deep down in the earth, and the earth's radium produces only enough heat to balance that which is continually being given off into space.

What Radium Looks Like

This is a tiny piece of the substance that is "worth three thousand times as much as gold."

Map-Picture Story of Uncle Sam's Resources and Great Industries

If you could visit the United States "all at once" this map tells in a striking way how its natural resources and the great industries based upon them would look, and where they are located:

WESTERN STATES.

1, Fishing Schooner. 2, Fishing Boat. 3, Salmon Fishing. 4, Apples. 5, Wheat. 6, Copper. 7, Hogs. 8, Sheep. 9, Lumber. 10, Lumber Boat. 11, Grapes. 12, Gold and Silver. 13, Silver. 14, Salt. 15, Cattle, Horses and Sheep. 16, Coal. 17, Alfalfa. 18, Copper. 19, Gold. 20, Peaches. 21, Oil. 22, Oranges. 23, Dates. 24, Vegetables (Irrigated Land). 25, Apples (Irrigated Land). 26, Sheep.

CENTRAL STATES.

1, Spring Wheat. 2, Lumber. 3, Copper. 4, Flour Mill. 5, Iron. 6, Apples. 7, Potatoes. 8, Dairy. 9, Butter and Cheese. 10, Cattle. 11, Horses. 12, Corn. 13, Packing House. 14, Lumber Yard. 15, General Manufacture. 16, Hogs. 17, Oats. 18, Cattle. 19, Apples. 20, Winter Wheat. 21, Lumber. 22, Furniture. 23, Automobiles. 24, Oil. 25, Tobacco.

SOUTHERN STATES.

1, Cattle. 2, Sheep. 3, Horses. 4, Oil. 5, Vegetables. 6, Lumber. 7, Sugar Cane. 8, Steel Mill. 9, Coal. 10, Cotton. 11, Turpentine. 12, Lumber. 13, Tobacco. 14, Vegetables. 15, Oranges. 16, Pineapples. 17, Oyster Boats. 18, Oyster Boat.

MIDDLE ATLANTIC.

1, Cattle. 2, Grain Elevator. 3, Butter. 4, Cattle. 5, Steel Manufacturing. 6, Oil. 7, Coal. 8, Peanuts. 9, Tobacco.

NEW ENGLAND STATES.

1, Lumber. 2, Fishing Boat. 3, Oyster Boats. 4, Paper Mill. 5, General Manufacturing. 6, Fishing.

The New Life on the Farm

Two Little Lambs

One of the strongest arguments in favor of farm life and the back-to-the-land movement is the good health and happiness that are the inheritance of the children reared in the country. All little folks are interested in animals and when they can have a baby lamb for a pet, as this little girl has—!

IF it were not for plants, we should all die for lack of food, shelter, clothing and fuel. The plant gathers certain materials from the earth and air and makes them into food for our table. Some of the food provided by plants such as nuts, apples, oranges, bananas, strawberries, lettuce, onions and the like, are ready for our use. Other plant products are used by us as food only after they have been especially prepared by means which we have invented. Among these products is wheat which we grind at the mill where the fine white part which we call flour is separated from the coarse, dark parts, called bran and middlings. We make the flour into bread, and it is ready to be eaten.

Food Made of Earth and Air

A long time ago when man lived in caves, he first discovered that wheat was good to eat but he did not know how to grind it into flour or bake it into bread. He gathered the berries of the

wild wheat plant with his hands, ground them between his teeth and ate them raw—flour, bran, middlings, and all.

Other plant products, such as grass, hay, and straw are not suitable as food for us, but they are good feed for many kinds of animals, as cattle and sheep for example. The flesh of these animals is very valuable as food for man; their wool and skins are valuable as clothing and their horns, hoofs and bones are serviceable for tools and ornaments. The fishes of the sea live upon plants or upon other animals which live upon plants.

The trees of the forest are so coarse and their bodies are so dense and hard that only the tenderest branches are useful as food for animals, but the trees furnish the material for shelter, fuel, tools, and ornaments. From the sap of some trees sugar is obtained, others produce medicines with which to cure our ailments; from others, fibre is obtained from which we make paper, clothing, rope and carpets.

Thus it is that the plants of the field, the forest, the plain and the sea, furnish either directly or indirectly all the food we eat, all the clothing we wear, all the fuel needed to keep us warm, and most of the shelter and medicine we require. Plants are, therefore, the basis of all life and most of the comforts and conveniences of the world.

The Beginning of Agriculture

To learn how to grow plants and how to feed and care for live stock was man's first great lesson in getting on in the world. In the beginning he did not plow, and sow, and reap as he now does and he had no tame animals to help him do his work. He depended upon wild plants and wild animals for his food and clothing. As he advanced in intelligence he learned to gather the seeds of the plants which he had found to be of greatest use to him and to scatter them on suitable soil, and to await the harvest which he gathered with his hands. He had not yet learned to help these plants by cultivating the soil to keep worthless plants from crowding them.

Primitive Agriculture

Though civilization began in Asia, many primitive methods of agriculture are to be seen there today. The picture shows Arabs scraping the soil (the process is not worthy of the name of plowing) with a curved stick in the same way that their forefathers did thousands of years ago.

The First Parents of the Potato and Apple

At the left is the solanum tuberosum, the plant from which man has developed the Irish potato. More familiar is the small, sour, wild crab-apple at the right, from which the hundreds of varieties of apples on the market today were produced. Both these plants changed their nature and habits to such an extent because man has vastly improved their environment. A constant and liberal supply of food deepens the color and increases the number of flowers and fruit. Shelter from bad weather lengthens the bearing season. All living things respond to a change in their environment and plants are not slow to alter their structure and habits because of it.

He soon began to tame some of the wild animals—the dog and the chicken among the first—and to make them help him get a living. Among the plants which man used at an early period in his civilization were wheat, barley, rice, millet, apples, grapes, olives, apricots, peaches, pears, figs, dates, bananas, quinces and sorghums for food, and flax and hemp for clothing. It is known that these plants were used by man more than four thousand years ago. Then, these plants were not so highly improved as they are now. The apple, for example, was a small, sour, wild fruit scarcely better than our native crab. Now, there are more than a thousand kinds of apples, varying in size from the small Lady apple to the mammoth Wolf River apple; differing in color from the bright red Jonathan to the Brown Russet; with all flavors from a delicate sweet to the sharpest acid; and ripening from early summer to late autumn.

When all the Apples were Crabs

The grape then was a small, sour fruit which grew as best it could in the thick forest. Now it is a large, luscious fruit, and is grown in a carefully pruned and thoroughly tilled vineyard.

Man has made equally marked improvements in his animals by selecting the best as parents. For a long time the hen would lay only one setting of from ten to thirteen eggs in a season. Then, obeying her long established wild instincts, she would insist upon sitting upon these eggs to hatch her young. After she had been tamed a long time, she began to lose the instinct to sit as soon as she had laid a nest full of eggs. Now we have a hen that has laid three hundred and fourteen eggs in a year, which is perhaps three hundred more than the wild hen laid.

The Training of the Hen

The Making of the Plant

Plants get their food from the earth and air. From the earth comes the mineral matter, or the part which is left as ashes if the plant is burned. There are six minerals which are necessary to the life and development of all plants—phos-

Tropic Vegetation on the

The Mountains of the Moon in central Africa, unlike many lofty peaks, are covered with an abundance of
the wind. But the Mountains of the Moon, though they are twelve thousand feet above sea level, have a moist,

vegetation. Even in the tropics vegetation is usually sparse on mountain tops because of the drying effect of warm atmosphere.

How Plants Break the Rocks

Here is a tree that is growing on a fragment of an old stone chapel and another that has split a rock. The upper one is only a sapling as yet, but its roots will creep down into tiny cracks in the stone and by their growth the rock will, in time, be split as the one in the lower picture is. It is in this way that plants hurry up the cracking and splitting up of big rocks and so help make soil.

phorus, potassium, calcium, iron, sulphur, and magnesium. From the air comes the part of the plant which passes into the air as gas when the plant is burned. The four elements which come from the air are just as necessary to the life of plants as are those which come from the soil. These are oxygen, hydrogen, carbon, and nitrogen. We shall learn a little later that most of our plants get their nitrogen from the soil, but the nitrogen in the soil came originally from the air. For this reason we say that the air is the source of this element of plant food. Thus we see that it takes ten separate elements to build a plant. All these elements are necessary for all plants. While only small amounts of some of these elements are needed, yet if only one were lacking the plant would starve to death, no matter how abundantly the other nine elements were supplied. A farmer could carry on his back all the ashes, for example, contained in a ton of wheat straw, but the straw could not be produced without the minerals the ashes contain. In this great mass of

The Chemistry of Growth

straw there would be no more than three pounds of phosphorus and less than a quarter of a pound of iron, but unless the soil contained these elements there would have been no straw produced, and of course, no wheat.

The plant takes its soil food through its roots and its air food principally through its leaves. But before any of these food materials can be taken up by the roots they must be dissolved in the soil water. Only a very small fraction of the minerals of the soil is dissolved in water at any one time. This is nature's way of taking care of the food of plants. The food is made soluble only about as rapidly as plants can use it. The rest of the food is safely locked up so that it cannot be washed away by rains.

Why the Plant Must Drink

We have just learned that the air is the source of all nitrogen, but the ordinary plant cannot use nitrogen in a pure state as it is in the air. Before nitrogen can become food for most plants it must be made to unite with hydrogen to form ammonia, or with hydrogen and oxygen to form nitric acid. In one of these forms it is carried into the earth in rain water, and it is in the soil that most growing plants must get their nitrogen. We shall learn a little later about a great family of plants called the legumes or the bean, pea and clover family which can use this pure nitrogen from the air and later leave it in the soil for crops like corn and wheat.

Nearly all soils contain enough magnesium, sulphur and iron to supply all the needs of the plants. Most soils contain enough calcium at least until after they have been cultivated for many years.

The quantity of phosphorus and nitrogen is low in most cultivated soils. These are the elements which it is first necessary to apply in fertilizers. In many soils potassium must be added also; and to nearly as many an addition of calcium in the form of finely ground limestone or air-slaked lime increases the yields of grain and clover.

Why Fertilizers are Needed

Thus we are especially interested in the elements of plant food which are apt to be lacking in our cultivated soils. It is these which we must buy in commercial fertilizers or manures and apply to most of our fields before they will give us satisfactory crops of wheat, hay, potatoes, and cotton. The elements of nitrogen, phosphorus, potassium and calcium are the ones in which we are especially interested. In order to be successful the farmer must learn about these elements and must know how to take care of them in his soil and where to get them when their supply in his soil runs low. This means that the farmer must first of all study his soil.

Three Millers That Grind the Soil

The earth's surface was once solid rock and was wholly barren. On it neither plants nor animals could live. The surface is now covered with a layer of soil varying from a few inches to many feet in depth. Out of the soil are growing great trees, tangled forests, rich pastures and fields of waving grains. This earth supports also millions of animals, both large and small. What has happened to bring about all this change in the fruitfulness of the earth's surface which once was so barren? Where did this soil layer come from, and of what was it

made? How does it happen that trees and grass and crops can grow in this soil when they couldn't grow on the rocks?

Soil is merely the rock of the earth's surface broken into fine particles, mixed with a small amount of vegetable and animal matter. The rock of the earth is still being slowly broken into fine particles by the action of air, water, and plants.

As soon as the rock surface had been acted upon by air and water, plants began to grow. It is true they were very simple plants and scarcely large enough to be seen with the naked eye, but they gathered materials from the air and used the substance of the powdered rock out of which to build their bodies. When these plants died, they added to the small beginnings of a soil, their bodies which helped to make the soil, and helped still further to break down the rock. The soil building went forward much more rapidly after plants began to grow than it had before and the farther the soil building progressed the larger the plants grew. Our soils have been thousands and thousands of years in forming, and, as we have just said, the process is still going on.

How Plants Made Earth By Growing

How Washing Wastes Soil

A heavy rain loosens the soil on a steep slope like this one so that the bank caves in. Proper drainage and grading would save the soil here.

For agricultural purposes we speak of the soil as the surface layer and the layer underneath the surface soil, to the depth to which the roots of plants go, as the subsoil. Beneath the subsoil usually lies a second subsoil extending to the rock or to that part of the earth's crust which has not yet been made into soil. The thin layer of surface soil, together with the layer of subsoil lying directly beneath it, sustains the millions of plants and in it hordes of small animals live. To keep this soil in such

a condition that it will produce large crops and feed man abundantly and cheaply, is one of the chief concerns of all the people, whether they live in the town or in the country. When the soil of a region fails to produce large enough crops to be cultivated with satisfaction and profit, the people of the town feel the effect just as fully as do the people of the country.

How Everybody Lives on the Farms

An Industrious Gardener

Varieties of Soil

There are two principal kinds of soil. One kind lies where it was formed and is called *residual* or *sedentary* soil. It is a soil which has never traveled. It has always remained just where it was made. The other kind has been carried away from the place in which it was formed by water, wind, or moving ice, and is called a *transported* soil, or a soil which has traveled.

Much more than half of the soils of the United States are residual, or sedentary, and they are of all grades, from very fertile to very poor. A limestone or a sandstone soil is a good example of a sedentary soil. A limestone soil is the result of the weathering or decay of limestone.

There are two principal groups of transported soil. The bottom lands along the streams, and the wind drifted soils of the prairies of the western states and some of the bluff lands along the Mississippi and Missouri Rivers and along the Yellow River in China, form one group. The glacial soils of Canada, and the northern part of the Mississippi Valley represent the other group. Glacial soils you know were brought down from the far north ages ago in great fields of moving ice, called *glaciers.* Some of the best soils of the corn belt were brought out of the frozen vastnesses of the North into the temperate climate of Illinois, Missouri, Iowa, Nebraska, and Kansas by the action of glaciers.

Corn Lands Built by the Glaciers

Agriculturally, soils are divided into clay, clay loam, loam, sandy loam, fine sandy soil, coarse sandy soil, fine gravel and coarse gravel. The best of these soils are the loams, the next best the clay loams, then

the sandy loams, and then the clay soils.

Some Soils Weak, Some "Stingy"

If a soil is very coarse as is a gravelly or sandy soil, it will not hold water well and crops will suffer from drought, and the air passes so freely through such a soil that the vegetable matter it contains is burned out quickly. Also the plant food the soil contains is carried away by the water which passes readily through the soil and flows out at some lower level as spring water. Coarse soils are easily tilled and are known as generous soils because they give up their plant food readily to the plants which grow upon them. For this reason soils of this type wear out quickly and require much attention on the part of the farmer to keep them in a good state of fertility.

If the particles are very fine, as is the case of a clay soil, the air enters slowly and on that account the plant food it contains is not made readily available to plants. Water moves through this type of soil slowly. As a consequence, these soils are usually wet and cold at least until late in the spring. Fine soils are known as stingy soils because the food which they contain is withheld from the growing crops more tenaciously than it is in sandy or loamy soils. As a result, clay soils wear well.

What Soils Are Best of All

The way to make a tight clay soil mellow is to add plenty of vegetable matter, such as barnyard manure or green manure, and remove the surplus water by drainage. Between the coarse and the fine clays are the loams. These soils are of medium texture, coarse enough to be easily tilled and to be reasonably generous, and yet fine enough to keep moist and wear well. Hence the loams are our best soils.

Busy Life in the Soil

We think of the soil as a mass of dead matter, but it is very much alive. A great many insects, bugs and worms live in the soil. Some of these, as the angle worm, improve the soil. There are also many other living organisms called bacteria, and fungi, in the surface soil. These are very important to soil fertility. They live for the most part on the vegetable and animal matter in the soil and cause it to decay and thus release the plant food this matter contains so that it may feed the growing crops. Some of these bacteria help to make the mineral elements of the soil, such as phosphorus and potassium, soluble so that they may be taken up by the plant roots. Others of these organisms improve the physical condition of the soil by making it more friable and crumbly. Some bacteria, however, work against the farmers' interest by locking up plant food instead of unlocking it. These hurtful bacteria are most active in soils which are poorly drained and which contain little vegetable matter.

Bacteria Friends, and Enemies

By adding vegetable matter, either as barnyard manure, or by plowing under a green crop upon which the helpful bacteria may feed and by proper drainage so that air may enter the soil and supply oxygen, the bacteria which are helpful will work actively and those which are hurtful will be almost entirely idle.

How Plants "Talk" About the Soil

Usually a soil that is dark in color, deep, and friable, or loamy is

fertile. Brown and red soils are also usually productive. White or bluish soils are generally infertile and difficult to cultivate.

The Plant as a "Report" Card

The plants which grow on a soil are, however, the best indicators of its value. If these plants are large, have coarse stems and large leaves, and if their foliage has a dark green color, it is safe to assume that the soil is rich. At least, we know that such a soil is rich in nitrogen and vegetable matter and that it is usually also rich in all the other elements necessary to plant growth. So you see the plant is a kind of report card about the soil; it tells you what the soil has been doing; how good a worker it is.

What Fertilizing Accomplishes

"An intelligent farmer feeds his crops just as he feeds his live stock. He learns what each crop requires and knows by experience what part of the food needs of his crop his soil may be expected to furnish." This illustration shows four panels of oats, two grown with and two without fertilizer. Notice that the fertilized plants are not only larger, but there are more of them and they have borne more grain.

A sparse growth and foliage of a pale green color indicate a soil poor in nitrogen and vegetable matter, and such a soil is apt to be poor in other respects, too.

The fact that legumes, such as the clovers, peas and the like, are growing naturally on a soil indicates that it contains plenty of lime. The absence of such plants and the presence of sorrels, and sour dock, suggests to us that the soil is low in lime and that the soil is acid. Soils on which pines and chestnuts are the natural growths are usually infertile and are especially poor in lime. Of course, large yields of such farm crops as wheat, corn, oats, clover, alfalfa and potatoes, when grown without manure or fertilizer, prove beyond question that the soil is productive, for the time at least.

The Chemist as a Prophet

How Chemistry Foretells the Crops

To learn how long a soil will remain productive under the ordinary systems of cropping, a chemical analysis must be made. This will tell us how much nitrogen, phosphorus, potassium, calcium and other plant food is present. We know how many pounds of each of these are removed by the crops we grow, and if we know how many pounds of each of these elements the surface soil contains, it is a simple matter of arithmetic to compute the number of crops such a soil will produce. It has been found by analysis that the surface foot of a very rich soil contains nitrogen enough to produce as many as one hundred and fifty crops of corn of forty bushels

each; enough phosphorus to last four hundred years at the rate of use which forty bushels of corn a year would require; and enough potash to last two thousand years. Reasonably productive soils will last only about half as long, and poor soils will become exhausted temporarily at least within less than a generation unless helped by the farmer.

While a chemical analysis will tell us accurately how much plant food is contained in a soil it will not tell us how much of the food is soluble or available to plants. The only way to determine this is by studying the natural growth on the land, or by testing it with various kinds of farm crops.

How a Soil Becomes Poor

A soil is nearly always more productive when it is new than it is after it has been cultivated for a number of years. This is because the soil gives up a part of its plant food, such as nitrogen, potassium and phosphorus, to every crop that is grown upon it. Some of the plant food of the surface soil is carried down into the subsoil beyond the reach of the plant roots by rain water as it passes through the soil.

Mother Nature as a Farmer

The surface of all cultivated soils is wasted by washing and by the action of the wind. It is always the best part of the soil which is carried away, leaving the poorest for the farmer to cultivate. Under a system of farming in which both grain and straw is removed from the land, nothing is being returned. In a state of nature, everything that the land produces goes back to the soil and nothing is removed. This explains why a new soil is fertile, and also suggests the reason why under a wasteful system of farming the soil becomes less productive the longer it is cultivated. No soil that is not supplied with plant food from some outside source, such as the overflow of a stream or by being fertilized by man, will remain productive indefinitely. Sooner or later

Plain Lesson in Subtraction

the soil will wear out unless the farmer takes care to put back into it each year a considerable part of that which his crops took out. Putting back each year a part of the plant food removed by the crop establishes a permanent agriculture and has in mind the needs of those who are to live after us, as well as of those who are now on the land.

Keeping up the Fertility

It is always cheaper and easier to keep the soil in a productive state than it is to repair it, once it is worn out. Attention should be given to the surface washing so as to prevent the waste of the soil itself, and to the stock of vegetable matter and the nitrogen, phosphorus, potassium and lime in the soil. If these matters are carefully considered the productiveness of the soil will not decline.

The waste from surface washing may be greatly reduced by keeping the soil covered all the year with a growing crop. In the winter some such crop as rye or wheat in the North and winter oats in the South

Preventing Waste from Washing

will hold the surface and largely prevent it from washing. In the spring the green crop may be plowed under, thus adding to the supply of vegetable matter in the soil. In regions of heavy rainfall terrace or contour farming, such as is extensively used in the Southern states, is

found to be very helpful.

For a long time it has been known that the growing of the same crop on the land year after year will not produce as good results as will the growing of a succession of different crops. Thus it has come about that different crops are rotated on the same land from season to season. Instead of growing corn on one field year after year, and wheat on another, a system is devised in which these crops will follow each other in something like this order: Corn, oats, clover, timothy and wheat; or corn, oats, clover, potatoes, and wheat; or cotton, oats, and cowpeas; or corn, oats, and clover. The advantages of rotating the crops instead of growing the same crop on the land continuously are numerous. All crops do not feed in the same area of soil. Some feed near the surface as wheat and oats, for example, and others in the deeper layers of the soil as clover, alfalfa and corn. Some crops require more of certain kinds of plant food than others; for example, the grains use more phosphorus and nitrogen than do the grasses. Potatoes and tobacco need more potassium than is required by most other crops. Clovers, alfalfa and other legumes need much lime. It is easier to maintain a balance in the food supply of the soil by judicious rotation than by constantly growing one crop.

Seven Furrows at Once

"The invention of the reaper by a Virginia blacksmith and farmer, Cyrus H. McCormick, marked the beginning of the extensive use of machinery on the farm. The farmer, once a slave to hand labor, is now the operator of large machinery. Before the invention of these machines, it required three hours of a man's time to produce a bushel of wheat. Now it requires only ten minutes."

Compare this gasoline traction-engine, the most modern device for plowing, with the wooden plow of our Puritan forefathers, shown below. At best the little one-horse plow only scraped the upper layers of soil, while the traction-engine plow leaves seven smooth, deep furrows.

Advantages of Crop Rotation

Some crops prepare for others, as

clover and cowpeas which leave the land mellow and in good condition for grain crops, potatoes or tobacco. Also the nitrogen which the clover and cowpeas have gathered from the air as well as the mineral elements gathered from the subsoil, are very helpful in feeding the succeeding crop. Some crops are cleansing and remove seeds, and by rotation, plant diseases and insect pests are held in check.

How Air Burns Up the Soil

The vegetable matter in cultivated soils is quickly burned out by the introduction of air through tillage. Soils low in this material have little life in them because there is little upon which the bacteria may feed. The soil becomes stiff and hard, and bakes after a rain. The mineral plant food contained in such a soil is locked up from the plants, and crops growing on such soils suffer needlessly during a season of drought. The supply of vegetable matter may be kept up by plowing under some green crop, such as rye, turnips, sweet clover, red clover or cowpeas every three or four years, or by applying barnyard manure at the rate of from five to six tons to the acre once every four or five years.

Feeding the Crops

The intelligent farmer feeds his crops just as he feeds his live stock. He learns what each crop requires and knows by experience what part of the food needs of his crops his soil may be expected to furnish. The remainder he must furnish either in barnyard manure or in chemical fertilizer, commonly called commercial fertilizers.

Fertilizers Used by the Ancients

Man learned to use barnyard manure long before Christ was born and the ancient farmers were well advanced in their understanding of the value of manure and the methods of preserving and applying it. Barnyard manure, in addition to supplying vegetable matter to the soil, furnishes the elements of food which the plants require for growth and development such as nitrogen, phosphorus, potassium, and lime. A ton of manure from some kinds of farm animals is more valuable than from others. The manure from poultry is the most valuable of any, ton for ton, that from swine and sheep is about of equal value, and stands next in the order of its worth, and that from horses is better than that made from cattle. The manure made from animals fed on grains or meal, especially those meals rich in nitrogen such as cottonseed meal, linseed meal and bran, is much more valuable than the manure from similar animals fed on coarse feeds, such as grass, hay, and fodder. Young animals produce manure of less value than do grown animals when the feed is the same, because the growing animal takes more out of the feed to nourish its body and therefore leaves less in the manure to nourish plants.

Farm Wealth in the Barnyard

About three-fourths of all the food which the plant takes out of the soil is to be found in the manure and only about a fourth is usually retained by the animal. Unfortunately, however, a considerable part of the plant food left in manure is lost through exposure of the manure to rains and by carelessness in handling it. Manure should, whenever possible, be hauled to the field while it is fresh. If it is necessary to keep it for any length of time it should be protected against rains and sunshine. A ma-

Don't Waste This Soil Food

nure spreader will save much hand labor and enable the farmer to use his manure to better advantage than if it is spread by hand.

It was the German chemist Liebig who, about the middle of the last century, discovered how to feed plants with chemicals. Until that time we only knew how to feed them with plant and animal products. Now the farmers of all European countries and of the eastern and southern United States use commercial fertilizers very extensively. The four elements of plant food which are sold in commercial fertilizers are nitrogen, phosphorus, potassium and calcium.

How Birds and Chemists Feed the Soil

Some nitrogenous fertilizers are derived from animal sources, as packing house products like dried blood, and tankage, and a fertilizer called guano, which is the excrement of sea fowls and is obtained from islands off the west coast of Africa. Another nitrogenous fertilizer is obtained as a by-product of the manufacture of gas and coke and is called sulphate of ammonia. Another important kind is nitrate of soda obtained from the rainless regions of Chile.

The two principal sources of phosphatic fertilizers are bone meal from the packing houses, and phosphate rock. The principal deposits of phosphate rock of the world are in the Carolinas, Florida, Tennessee, Georgia and Arkansas.

Where Guano Comes From

Thousands of sea-birds have visited the Guano Islands as far back as the records of mankind go. They lay their eggs and hatch their young there, and, incidentally, leave enough nitrogenous waste in their temporary homes to furnish fertilizer to farmers all over the world. The fertilizer is called guano, from the islands where it is gathered.

The principal source of potash is the Stassfurt mines of Germany where it is believed that there is enough potash to last the world for five thousand years. Wood ashes are also used to some extent as a source of potash for plants.

Calcium fertilizers are obtained from the limestone rock and are in the form of finely ground rock, or of burned lime, air-slaked.

How to Use Commercial Fertilizers

Only a part of the food required by plants is usually given in the fertilizer, the soil being relied upon to supply the rest. Thus, for example, a crop of thirty bushels of wheat to the acre, including the straw, would consume about forty-eight pounds of nitrogen, nine pounds of phosphorus, twenty-four pounds of potassium and six pounds of calcium. Most wheat soils in America may be relied upon to furnish all the potash required. If clover has immediately preceded wheat in the rotation, a part of the nitrogen gathered from air by the clover and left in the soil in its roots and stubble will be available to the wheat plants. Then, the soil will supply a part of the nitrogen required so that only from four to ten pounds of nitrogen would need to be given in the form of a fertilizer. Usually only from one-half to two-thirds of the phosphorus is supplied in that form.

How Much the Wheat "Eats"

The ordinary commercial fertilizer consists of from only about one-tenth to one-third plant food. The rest of the material is of no agricultural value and is called a filler. A very common way of making up commercial fertilizers is to have them contain two per cent of nitrogen, eight per cent of phosphoric acid, and two per cent of potash. Such a fertilizer would be one-eighth plant food and seven-eighths filler. The amount of commercial fertilizer applied varies from less than a hundred pounds to more than a thousand pounds to the acre, but from one hundred and fifty to three hundred pounds an acre is the usual amount.

Ground limestone is applied at the rate of about two tons to the acre and air-slaked lime at the rate of about two hundred pounds, or about twenty-five bushels an acre.

The Control of Water in the Soil

All plants require large amounts of water for their growth, but only a few crops, such as rice, thrive in soil filled with water. Saturated soils are cold, clammy and unfit for the production of ordinary farm crops. The remedy is to remove the surplus water by drainage so that the land may be plowed and planted in proper season and so that the air may enter the soil to unlock plant food and to help feed the plants. Wet soils are made dry by surface ditches or by tiles or burnt clay tubes, laid from two to four feet beneath the surface and having an outlet into a gully or stream below. The tubes or tile are a foot in length and the water enters at the joints where two tiles join. Surface drainage is wasteful of land and tends to surface washing. Tile drainage is costly and on clay soils removes the water slowly.

Why Soils Are Drained

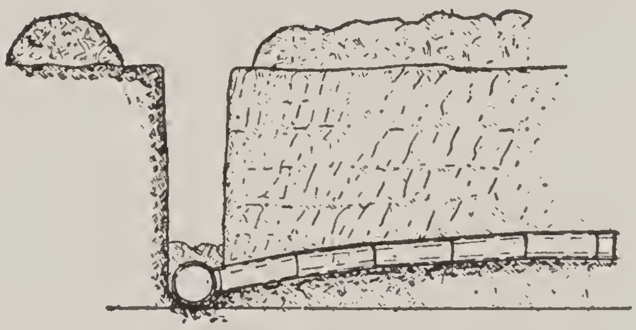
It is more often true that there is not enough water to supply the needs of the growing crops than that there is too much. The remedy is to arrange for a system of irrigation or to practice dry farming. Applying water artificially or irrigating the crops is one very common remedy for the lack of moisture in the soil. Irrigation has been practiced since ancient times and some of the irrigation ditches of ancient Egypt are still in use. Water resulting from the melting of snow on the mountains is brought long distances in ditches and spread out on the surface of the field where the crops are growing. In other cases water is pumped from

The Practice of Irrigation

Draining a Clay Soil

"Wet soils are made dry by surface ditches or by tiles or burnt clay tubes, laid from two to four feet beneath the surface and having an outlet into a gully or stream below. The tubes or tile are a foot in length and the water enters at the joints where two tiles join. Surface drainage is wasteful of land and tends to surface washing. Tile draining is costly and on clay soils removes the water slowly."

A Branch Drain Entering the Main Tile Line



Where there is a main tile line and several branches, the branch lines should slope down to meet the larger, main drainage tube. If they are both on the same level, silt from the main line will collect at the mouth of the branch tile and stop it up.

the earth and spread over the fields near the wells or carried in ditches or pipes to the regions where the crops are grown.

In regions of deficient rainfall in which water for irrigation is not available, systems of dry farming are practiced successfully. A rainfall of less than thirty inches a year usually requires some irrigation or a special type of farming. In China, wheat has long been grown successfully with less than twenty inches of rainfall. In the Columbia River basin of the United States, wheat farming is successfully conducted under a rainfall of ten or twelve inches a year. Dry farming gives attention to getting all the rain water into the soil by keeping the surface cultivated and rough so that there will be little or no surface run-off. It also gives attention to the holding of the moisture in the soil and to the preventing of waste by evaporation. This is accomplished by surface tillage. Tillage also keeps down weeds, which, if left to grow, would rob the soil of its moisture. In dry farming, crops such as wheat, the sorghums, Sudan grass and millet, are grown

because they require less water than do some other crops like corn, alfalfa and clover. In some cases the practice is followed of growing a crop only one year in two, cultivating the land carefully both years to save moisture. This is a very old system and is known as "summer fallow," or letting the land lie fallow every other year as was frequently recommended in the writings on agriculture in Biblical times.

Dry Farming

This land is lying fallow during the winter. It is plowed in deep ridges to catch and hold all the moisture possible. Land is often cultivated in this way in regions having meager rainfall.

Some of Our Principal Crops

Wheat is the most important food grain of the great Caucasian race and is one of our oldest domesticated plants. Wheat is still growing wild in Palestine although it was cultivated in Egypt before the Pyramids were built and in China nearly three thousand years before Christ was born.

Most of the progress of the agriculture of the world may be traced through the changes in the methods of growing wheat. At first the wild berries were gathered by hand for food and later a few seeds were sown on unprepared soil. Afterward the soil was plowed for wheat with a crooked stick drawn by women. The seeds were sown by hand until within a generation ago. In the early days the seeds were covered by driving cattle over the field.

Ancient History of Wheat

For a long time the grain was harvested by pulling up the plants or by breaking off the heads by hand. Later a stone sickle which half cut and half broke the straw was used as a reaper. Then came the iron sickle which marked a great advance and which is still in use in many parts of the world. The Romans invented the cradle which was used in this country until after 1850.

The invention of the reaper by a Virginia blacksmith and farmer, Cy-

Varieties of Wheat

"Wheat is the most important food grain of the great Caucasian race, and is one of our oldest domesticated plants. Most of the progress of the agriculture of the world may be traced through changes in the methods of growing wheat."

Seven different kinds of wheat are shown here. From left to right, they are: Polish wheat, Durum wheat, hard spring wheat, hard winter wheat, soft winter wheat, Alaska and club wheat.

rus H. McCormick marked the beginning of the extensive use of machinery on the farm. The improvements of the plow and of the thresher kept pace with the changes in harvesting machinery so that the farmer, once a slave to hand labor, is now the operator of large machinery. Before the invention of these labor-saving machines, it required three hours of man's time to produce a bushel of wheat. Now it requires only ten minutes.

A Bushel of Wheat in Ten Minutes

Varieties of Wheat

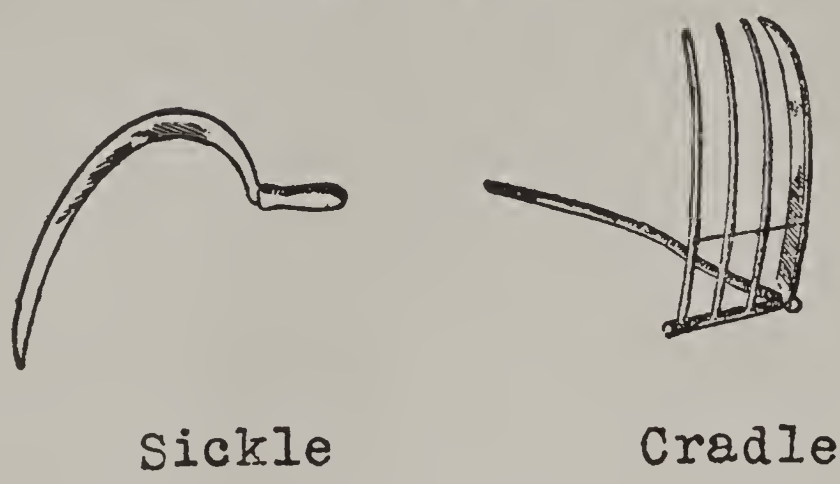
There are eight classes of wheat. Common wheat constitutes nine-tenths of the wheat of the United States. Durum wheat is used for making macaroni. Speltz is not grown in the United States, but it is grown in Southern Europe, where it is used as feed for live stock. Emmer is grown in the northern Great Plains states and is used for stock feed. Club wheat yields heavily, and is especially adapted to the Pacific Coast. Poulard wheat is not grown in the United States, but is grown in the countries bordering the Mediterranean Sea, where it is used in the manufacture of macaroni, and when mixed with common wheat, is made into flour for bread. Polish wheat is grown chiefly in Russia and in the countries bordering on the Mediterranean Sea, and is used in the manufacture of mac-

Geography of Wheat

aroni, spaghetti, and similar products. Einkorn is a primitive type of wheat, and is of no importance.

Common wheat is divided into winter wheat and spring wheat. Winter wheat is grown in the temperate regions of the world, and is sown in the fall and harvested the following June or July. It constitutes more than two-thirds of the wheat grown in the United States. The winter wheats are divided into hard and soft types. The hard winter wheats, such as the Turkey and Kharkof, both of which came from Russia, are grown principally in Kansas, Nebraska and Colorado and, like the hard spring types, make a splendid baking flour. The soft wheats, such as the Fulcaster, Fultz and Zimmerman produce a flour especially desirable for making biscuits, cakes, pies and the like.

Early Tools for Harvesting Wheat—The Sickle and the Cradle



After the stone sickle, "came the iron sickle, which marked a great advance and is still in use in many parts of the world. The Romans invented the cradle, which was used in this country until after 1850."

Spring wheat is adapted to the colder regions, and is sown in the spring and harvested in August. The principal spring wheat types in the United States are the Fife wheats and the Bluestem, which furnish the hard spring wheat from which such excellent bread flour is made, and the Durum wheat, which produces a flour used chiefly in making macaroni.

How Rice is Grown

More than half the people of the world live principally upon rice. Rice is, therefore, the principal food of more people than use all the other grains combined. It is grown principally in China, Japan, India and Africa, although it is becoming an important crop in the warm, low-lying parts of the United States, particularly in Louisiana, Texas and Arkansas.

Upland and Lowland Rice

There are two classes of rice, the upland and lowland. The upland class is grown very much as are the other grains, wheat and oats. Lowland rice, the more important variety, unlike most other agricultural plants, requires that the soil be saturated and covered with water during most of the growing period.

The field should be level, so that when it is flooded the water may be at the same depth over all parts. Each field is surrounded by a levee or bank a foot or more high, to hold the water. In the United States, the land is plowed in preparation for rice, very much as for wheat, and it is seeded at the rate of from one and one-half to three bushels per acre at some time from March to May. The field is flooded at once, if necessary, to germinate the seed. If not, the field is flooded when the plants are about seven inches high, and is kept covered with water to a depth of from four to six inches, until the crop is nearly ripe. At that time the water is drained off, so that the rice may ripen and the land may become firm enough to permit the harvesting of the grain with a machine.

In Japan and China the land is flooded before the soil is prepared. It is then dug by hand twice to a depth of nearly a foot. Instead of sowing the seeds in the field where the plants are to grow, the seeds are sown in a plant bed, and later each plant is pulled and transplanted to the field by hand. The plants are set in rows about ten inches apart. This means between eighty thousand to one hundred thousand plants must be set on each acre. Women do most of the work of transplanting. What would our American women think if they had to transplant all our wheat and oat plants, and if they were obliged to stand with mud and water half knee-deep while doing this work, as do the Oriental women in transplanting rice? In Japan the ripe grain is harvested with a hand sickle, such as was used before the time of Christ, and the grain is stripped from the stalk or threshed with a flail.

Setting Out Rice in the Orient

A Field of Kafir Corn

Kafir corn is a tropical and semi-tropical plant, a relative of field corn and sorghum. In Africa and India it is used like millet, as a grain food, but in this country it is chiefly a forage and ensilage crop.

Cotton—Its Culture

The cotton plant furnishes the principal fibre used in making cloth. Other fibres are used for this purpose, such as the wool of sheep and goats, the fibres of hemp and flax plants, and the thread spun by the silk worm to shield itself while it changes into a butterfly. Cotton is cheaper than any of these other fibres, and is adapted to a greater variety of uses.

Cotton cloth serves the rich and the poor equally well. Out of cotton the coarse sail cloth and tarpaulins are made, as well as the fabrics which we wear and which adorn our homes.

Gun cotton, the deadly explosive, and absorbent cotton, so helpful in healing wounds, are both made from cotton. The oil extracted from the

cotton seed is valuable as a food, and is widely used as a substitute for olive oil and lard. Cottonseed meal, the meat of the seed after the oil is extracted, is a valuable stock feed, and is exported extensively to Europe. It is also used in this country as an important feed and as a fertilizer. Cotton is the principal crop of the southern states, and is our leading article of export to foreign countries. It brings to the United States more money than is derived from the sale of any other agricultural product.

So Many Things Come From Cotton

The United States produces nearly two-thirds of the cotton of the world, Egypt about one-fifth, and India about one-eighth. The cotton plant is a native of the tropics, and is supposed to have originated both in India and in America.

The Big Export Crop

"The two classes of common cotton are the short staple and the long staple. Cotton whose fiber is not more than one and one-fourth inches long is classed as short staple, and represents the bulk of our product. Long staple cotton brings a high price and is used in making laces and the finest cotton clothes."

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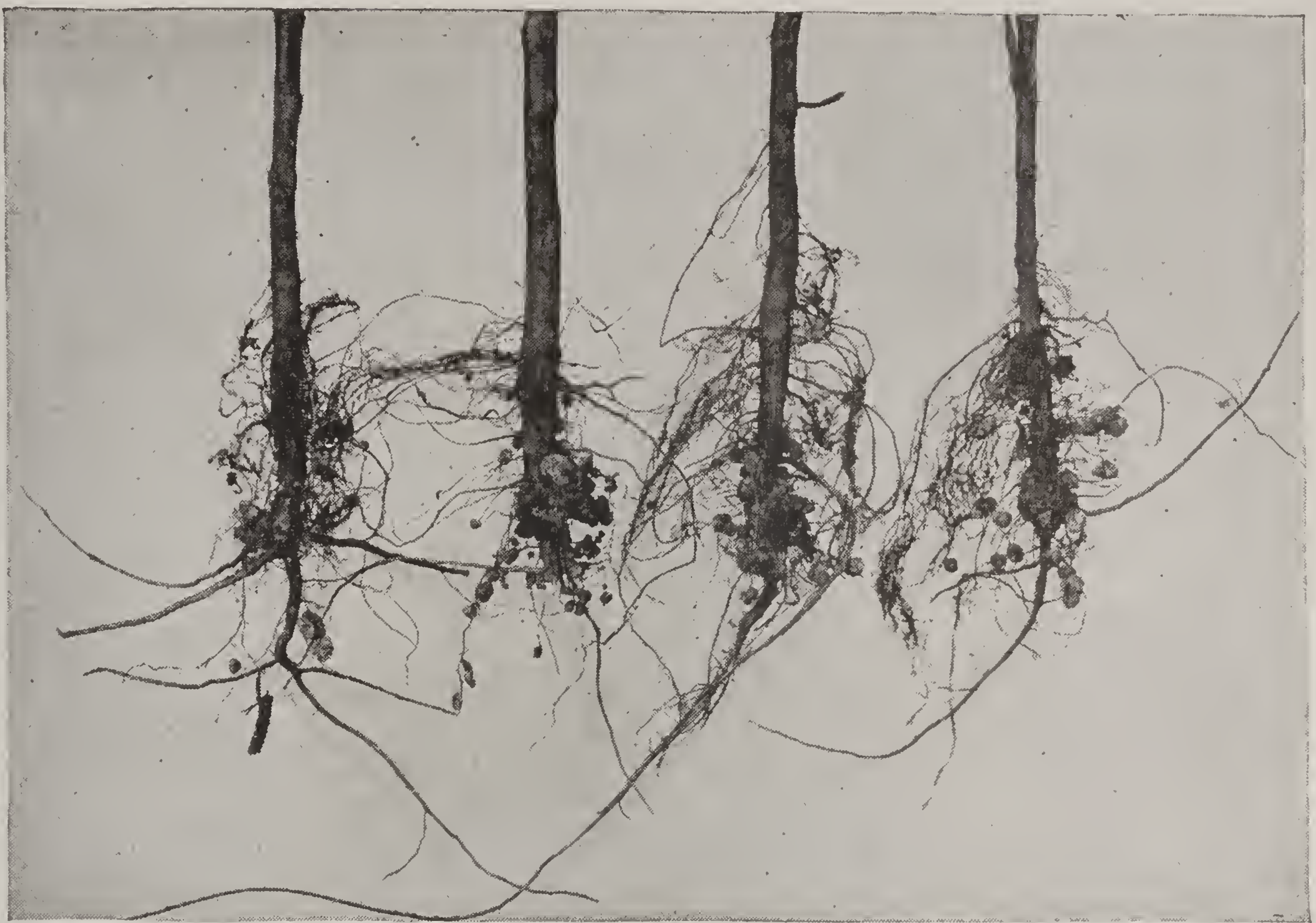
Very Interesting Things About the Seeds

Much progress has been made in cotton production, through the use of carefully selected seed. Early maturity is secured by choosing seed from plants with short joints; productiveness is increased by selecting seed from bolls with five instead of four locks; bolls which open excessively waste the cotton in storms, while those which open sparingly are difficult to pick. Intermediate opening tendency is to be sought in selecting seed. Earliness and long staple are not secured in the same plant. Large seeds indicate a small percentage of lint.

The cotton boll weevil, an insect which lives in the squares or young bolls of the cotton plant and causes them to fall before they become grown, is the most destructive insect to Southern agriculture. Early maturing varieties of cotton, clean culture, and the thorough cleansing of the field after the cotton has been

How to Get Rid of the Weevil

Little Nitrogen Factories



"The legumes help to make our soils more productive by adding nitrogen gathered from the air. It is true the legumes do not take the nitrogen directly from the air, but do so through little creatures called bacteria, which live on their roots. These bacteria make protein and store it in their own bodies. These bodies are easily seen if we examine the roots of cowpeas, clover or alfalfa plants. They are in the form of little knots called nodules or tubercles attached to the roots."

picked, including the burning of all stalks, and dead bolls, will destroy most of the weevils, and many of the immature insects, and will hold this pest in check.*

Here is the Legume Family

One of the most important as well as the most interesting groups of plants is the legume family, of which clover, peanuts, peas and beans are familiar examples. No animal, as you learn in our article on foods, can grow without protein. A part of the animal body is worn out during the activities of the day, and must be repaired while the body is at rest at night. Without protein the repair could not be made and all animals would soon die. Poultry could not lay eggs without protein being supplied in their feed, for the white of egg is almost pure protein. Cows could not give milk without protein, for the curd of milk contains much protein. We rely principally upon the legumes for protein, for both man and beast. Beans, peas, lentils, and peanuts for man and the clovers, alfalfa, cowpeas and soy beans for animals.

To Repair Our "Body Houses"

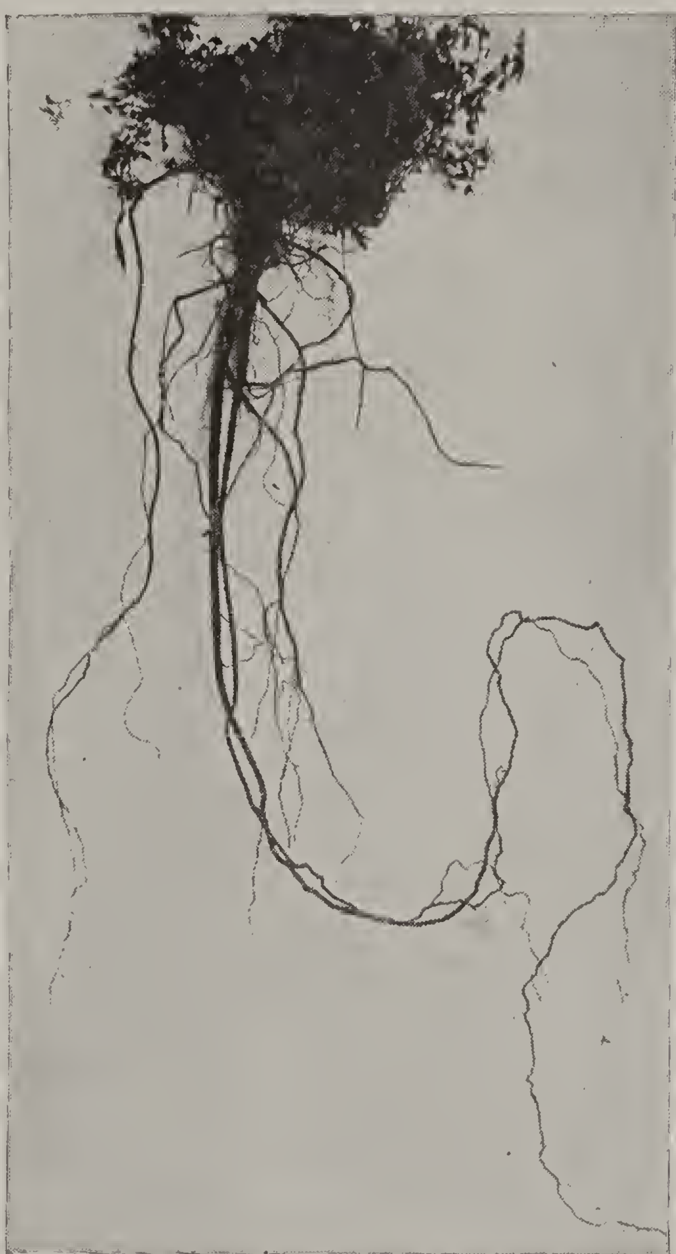
The legumes also help to make our soils more productive by adding nitrogen. This nitrogen they have gathered from the air. No other agricultural plants have the power to feed upon the nitrogen of the air. Corn, wheat, cotton, and all the grasses get their nitrogen from the

*The subject of corn and its culture has been fully dealt with in a separate article.

soil, although their leaves are constantly bathed in air, which is four-fifths nitrogen It is true the legumes do not take the nitrogen directly from the air, but do so through little creatures called bacteria, which live on their roots. These bacteria feed upon the nitrogen of the air, and combine it with the other elements required to make protein, and to store the protein in their own bodies. These bodies are easily seen if we examine the roots of cowpeas, clover, or alfalfa plants. They are in the form of little knots called nodules or tubercles attached to the roots. On the clover and alfalfa plants the nodules resemble clover seed. On the cowpea and soy bean they are as large as a pea or bean and in some cases are half an inch in diameter. When these nodules have become fully grown they produce very little seeds called spores and die. The spores are so small that they cannot be seen except with the aid of a microscope. After the tubercles die, they still cling to the roots of the legumes, and the legumes feed upon the protein and other materials these bodies contain, storing in the roots, stems, leaves and seeds the materials which were gathered by the tubercles. The spores or seeds become scattered through the soil to produce tubercles on the roots of other clover or cowpea plants.

The Little Nitrogen Factories

An Alfalfa Plant



"By far the most productive legume is alfalfa. The hay it produces is the best we have. One sowing under the most favorable conditions will last a lifetime and from three to six crops may be cut each year." This alfalfa plant is nine years old and its roots are over nine feet long. It is characteristic of alfalfa to go deep into the soil for its nourishment."

Some soils have to be inoculated or seeded with these spores before legumes like alfalfa or red clover will thrive on them. Legumes do not thrive on most soils without tubercles because they cannot get all the nitrogen they need without their help. A soil is inoculated by sowing upon it three or four hundred pounds of fresh soil from a field which is already supplied with the spores, and harrowing the surface promptly to cover the spores so they will not be killed by drying or by the action of sunlight. These organisms do not thrive well in soils which are poor in lime. This explains in part why legumes are so partial to soils rich in lime and why an application of ground limestone to the soil which has been cropped for many years may make it possible to grow red clover or alfalfa when it had failed to grow before.

All things considered, the clovers

A Field of Clover Ready to Cut

"The clovers are the most important group of legumes. The principal kind is the red clover, a plant which has not been domesticated more than three centuries. The plant lives two years, or is what we term a biennial, and fills a most important place in the crop rotation of the regions of the United States north of the Ohio River and west of the Missouri River."

The Different Clovers

are the most important group of the legumes and comprise a number of kinds adapted to widely different conditions of soil and climate. The principal kind is the red clover, a plant which has not been domesticated more than three centuries. The plant lives two years or is what we term a biennial, and fills a most important place in the crop rotation of the regions of the United States north of the Ohio River and west of the Missouri River. It is also very widely grown in the temperate regions of Europe and Asia. Other important clovers adapted to temperate climates are white clover, and sweet clover. Those adapted to the warm climate of the South are Japan clover and burr clover.

By far the most productive legume is alfalfa. The hay it produces is the best we have. One sowing under the most favorable conditions will last a lifetime and from three to six crops may be cut each year. Except for the fact that it does not thrive well on many soils it would be by far the most valuable of all our legumes. But we are rapidly learning how to grow this most valuable plant in many regions where it has hitherto failed so it may become even more widely used than red clover.

Why Alfalfa Is So Valuable

No greater service can be rendered the agriculture of any community than to discover how to grow alfalfa in that community. Soils upon which alfalfa has not been grown usually need inoculation. If they have been in cultivation for many years a liberal application of barnyard manure plowed under a few months before alfalfa is sown will always be helpful and in most cases will be necessary. If red clover does not thrive on such a soil, a ton or more of ground limestone applied with the manure may be the means of securing and holding an alfalfa stand. It is often desirable to precede alfalfa

with a crop of sweet clover and plow the sweet clover crop under while it is yet green. The bacteria or organisms which cause the nodules to grow on the roots of sweet clover are supposed to be closely related to those which grow on alfalfa and this is one way of inoculating the soil for alfalfa. The land should be plowed in the spring to a good depth, but not much deeper than usual, and should be cultivated on the surface often enough to keep down the weeds until the middle of August or early in September when the alfalfa seed should be sown at the rate of fifteen or twenty pounds to an acre and covered lightly with a smoothing harrow. Alfalfa should not be cut or pastured the fall it is sown unless the growth is exceptionally vigorous and then cut it very high. Avoid cutting the following year before the plants are one-third or one-half in bloom. Early cutting is very hurtful to alfalfa, especially before the plants are well established, and greatly increases the chances of losing a stand.

How to Grow and Handle Alfalfa

Some of the other important members of the legume family are the soy bean which is very widely used in Japan and China and India as a human food, and which is increasing in importance in this country as a stock food; the cowpea, one of the most valuable plants grown in the South; and the peanut, also a plant of great importance in southern agriculture. The two last-named legumes are used as food for both man and beast.

Soybeans Cowpeas Peanuts

Animal Life on the Farm

Man is the only animal that has tamed many plants and animals and made them help him. Of course, it was a long time ago when he first began to select and tame those plants and animals which could best serve his needs. At first the benefits were slight because man had not yet learned much about the animals and plants.

The people who early learned how to tame the wild animals of the forests and to make them help carry the loads and till the soil and furnish meat and clothing were the ones who made the most rapid progress.

How Man Got His Farm Animals

The Indians of America had tamed but one animal, the dog, when Columbus discovered this country, and that perhaps is one reason why they had not become civilized beyond the fishing and hunting stage of existence. As soon as the white man of Europe settled here he began to raise crops and to build towns. He had the help of horses, cows, sheep, pigs, chickens, and geese, which he had brought with him. He did not have any turkeys for he did not know about them until he came to America where he found them running wild. The Indian had known of the turkey for a long time but he had not taken the trouble to tame it.

The principal animals which man uses are horses, cattle, sheep, swine, carabao or water buffalo, elephants, camels, dogs, reindeer, chickens, ducks, geese, turkeys, guineas, honey bees, and silk worms. In the United States we use all those named except the elephant, camel, and silk worm. The carabao is used in the Philippine Islands and the reindeer

A Perfect Menagerie!

Little Porkers

in Alaska. But the animals of principal importance to us are horses, cattle, swine, sheep, and chickens. These we call farm animals. They have been domesticated so long and have become so used to living with man that they have lost their wild instincts and are now dependent upon man for food, shelter, and protection. If they were turned out into a wild forest and forced to shift for themselves they would hardly know how to get along. Now the farmer grows many crops especially to feed to his stock. He builds houses to shelter them from the storms and he guards them against the attacks of their enemies, as his chickens against hawks and his sheep against wolves.

Horses help to raise the crops and to market such of them as are sold. It is true that the horses eat a part of what they have helped to raise, yet only a small part. Some of the grain which the horses helped to raise is fed to hogs and they in turn give us pork and bacon and ham. Another part may be fed to cattle in return for which we get beef, and milk, and butter, and leather. Sheep may take a part of the feed and give us back mutton for our table and wool for clothing and carpets. Fowls depend upon us for much of their food and give in return eggs and meat, and feathers for pillows and for ornaments.

Good Friends With Four Feet

Much of the material which these farm animals eat is so dry and hard and coarse that we would not relish it as food and much of it we could not eat. The grasses of the pasture for example, furnish splendid nourishment for all kinds of farm animals but we would not relish it as food for ourselves. Poultry and swine eat a great many insects, and sheep and cattle feed upon a great many kinds of weeds. All farm animals relish bran but we insist upon eating white bread. Corn is the only important feed for stock which might also be used generally as food for man, but most people prefer wheat bread to corn bread. So for the most part, farm animals are used to change materials of low grade like grass, hay, and bran into products of very high grade like beef,

milk, bacon, butter and eggs.

It takes many pounds of these low grade materials to make a pound of such valuable products. Usually from six to ten pounds of grain and hay are required to make a pound of gain in a beef animal. A pig will gain a pound on from three to six pounds of grain. One pound of grain in addition to roughage will produce two or three pounds of milk, and from four to five pounds of grain and packing house by-products will produce a pound of eggs. In addition to greatly refining the materials which they consume, farm animals greatly concentrate them. That is, a pound of any of these animal products is much more valuable as food for man than is an equal weight of the original material from which it was made.

Changing Grass Into Meat

It is also true that these animals do not use all the materials they eat in making the products which we keep them to make. Only about half the feed they eat is digested and it is only the digested portion which they can use. Then a part of that which is digested is used for keeping the body warm, in pumping the blood, in breathing, in walking about, in chewing and digesting the feed, thus leaving less than a quarter of what was eaten in many cases to be used in making meat, wool, milk, eggs, or feathers.

Changing Coarse, Dry Grass into Juicy Beef

"Much of the material which farm animals eat is so dry and hard and coarse that we would not relish it as food, and much of it we could not eat. For the most part, farm animals are used to change materials of low grade like grass, hay and bran into products of very high grade like beef, milk and eggs. Usually from six to ten pounds of grain and hay are required to make a pound of gain in a beef animal."

Improving the Breeds of Animals

After man had kept these animals a long time they began to change in form and size, and he began to select those which best suited his use. If he wanted horses to haul heavy loads he chose the largest. If he wanted a horse to ride when going to war he chose that which was fleetest and most intelligent and companionable. The soldier's horse in all ages has been his companion. In cattle, if milk and butter were the products desired, those cows which produced the greatest amount of these materials were chosen. If it was meat that was wanted, the heav-

iest, thickest bodied cattle were chosen.

Then some people fancied cattle that were red in color, others, those that were black, and yet others, those that were roan. As a result of all these changes and selections we have many different kinds of horses, cattle, sheep, swine and poultry adapted to different uses. There is the ponderous draft horse that pulls the plow for the farmer and draws our heavy loads on the streets. The draft horse was raised in the rich pastures of France, England, Scotland and Belgium, and has had all the feed it could eat for many generations and every year for a long time the largest and strongest have been chosen to be the parents. No wonder then that these horses have grown to weigh more than a ton each. All draft horses do not belong to the same breed. We have the Percheron from the Province of La Perche, France; the Belgian from Belgium; the Clydesdale from Scotland; the Shire from England; and many others of lesser importance. Then there are the ponies kept principally for children to ride and to drive. Ponies came from the cold, bleak hills of Wales and of the Shetland Islands where they got only such poor feed as they could find growing among the rocks. It is no wonder that they are dwarfed, until they weigh only three or four hundred pounds each. It takes six or seven ponies to weigh as much as one draft horse. Between the draft horse and the pony are many horses of different sizes and uses. We have the proud saddle horse, the fleet English thoroughbred used for racing and hunting, and the courageous and faithful Arabian horse which is as much a companion as a helpmeet to the man of the desert. There are the driving horses such as the American and Russian trotter, swift, coura-

Different Types of Animals

Why Shetlands Are so Small

"I've Got Some Baby Ducks!"

"Dinner Time"

What All Children Tease For

Shetland ponies are small because their ancestors could not grow very big on the scanty food supply in the Shetland Islands. They are born pets and all children love them. Here is a fine 350-pound specimen.

geous and beautiful, and a large group of heavier horses used for drawing carriages and coaches. These are the Hackney, the French coach, and the German coach.

There is no less a diversity among cattle. Some are kept almost entirely for the milk and butter they produce as the Holstein, Jersey, Guernsey and Ayrshire, while others are kept entirely for the beef they

Milk and Beef Cattle

produce as the Hereford, Angus and Galloway. The cattle known as Shorthorns are excellent for beef production and produce a moderate amount of milk and butter as well. The Red Polled cattle possess both dairy and beef qualities but neither to a very high degree. By reason of their value for both uses they are called dual purpose cattle.

The two principal classes of swine are the bacon type and the lard type; the one long, narrow and tall, the

Lard and Bacon Hogs

other thick, short, and heavy set. As their names indicate, the bacon type is used principally for the production of bacon, the lard hog for the production of fat. Both produce good hams. The bacon type is grown principally in the Northern states and Canada and in Europe. The lard hog is the type grown in the corn belt of the United States.

There are two great classes of sheep, the one grown principally for wool and the other kept chiefly for mutton. We further divide the

Wool and Mutton Sheep

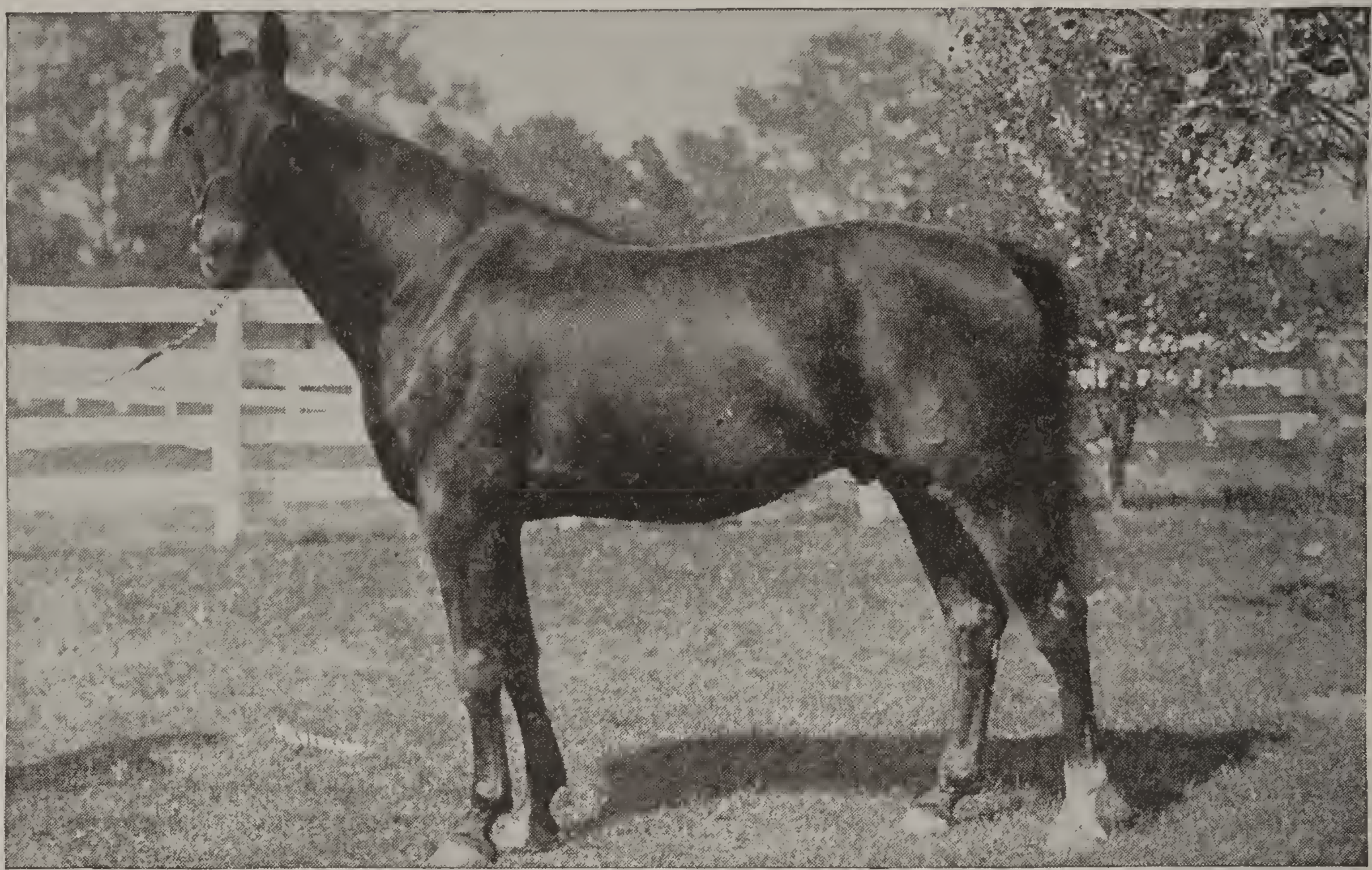
group kept principally for mutton into long wools, as the Cotswold, Lincoln and Leicester, and the medium wools, such as the Southdown, Shropshire, Hampshire, and

Clydesdale and Belgian Draft Horses

"The draft horse was raised in the rich pastures of France, England, Scotland and Belgium, and has had all the feed it could eat for many generations, and every year for a long time the largest

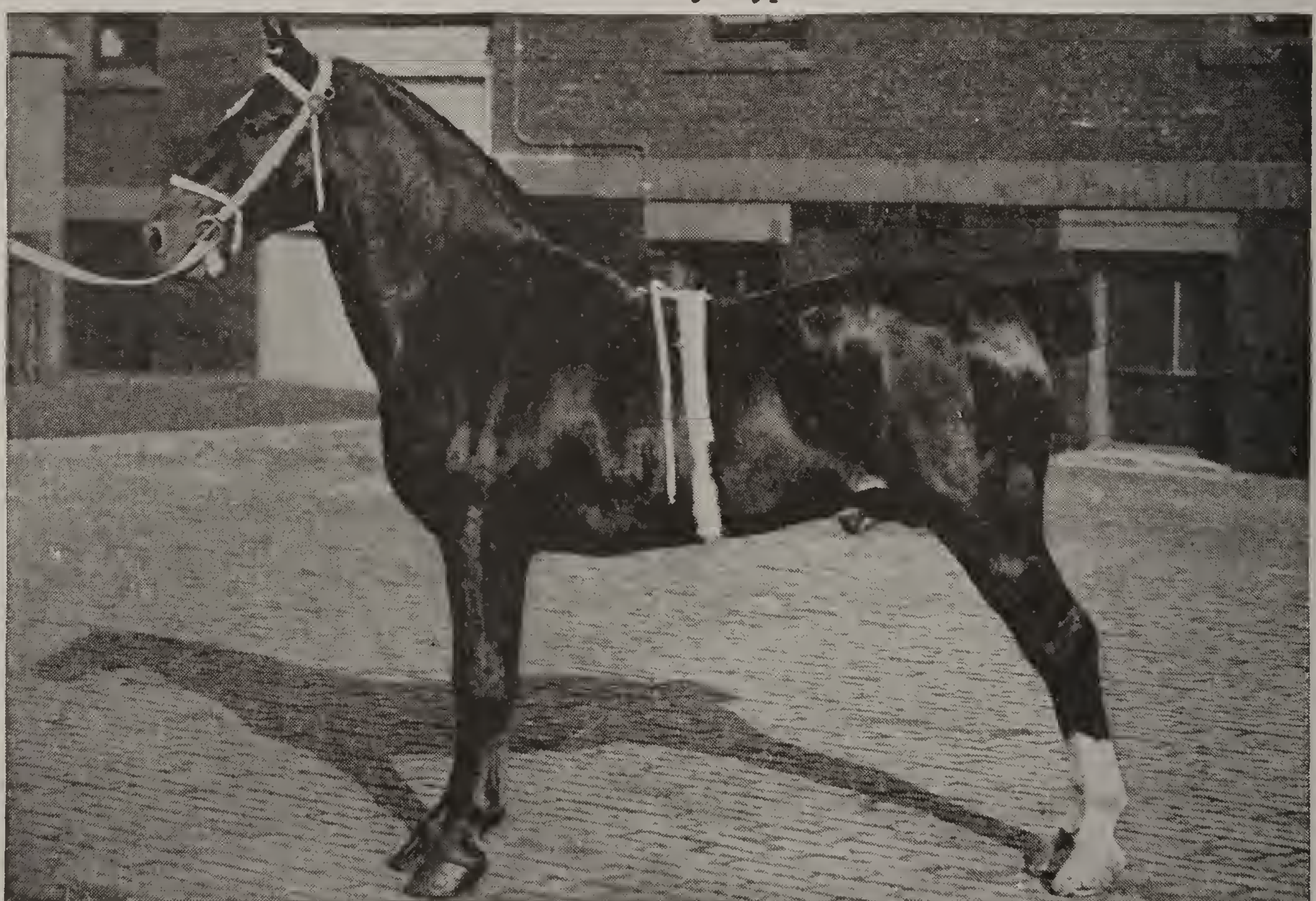
and strongest have been chosen to be the parents. No wonder, then, that these horses have grown to weigh more than a ton each." The first horse is a Clydesdale and the second a Belgian.

The American Trotting Horse



Trotters are built for speed and endurance, not for great pulling power as the draft horses are. Compare the slim, graceful lines, slender neck and long legs of this trotter with the stockiness and heavy muscles of the horses on the preceding page. And see the intelligent, questioning look in this horse's face—as if he were asking the camera man what is happening. Generations of association with man has given him an expressive face, as well as a beautiful body.

The Hackney Type



This black beauty is a Hackney, a carriage and light coach horse. Hackneys have been bred for both strength and speed and combine the characteristics of both draft and trotting animals, as you can see by a comparison of the pictures.

Dorset, but all are mutton types.

The fine wooled type have short wool and are represented by the great class of Merinos. The Merinos or fine wools are especially adapted to living in large flocks on the ranges where vegetation is sparse and where hardiness is a valuable asset. The mutton types are adapted to farm conditions where ample feed, good care, and shelter are provided. A long time ago sheep were known as the animal with a golden hoof because they enriched the owner and also enriched the land upon which they grazed.

The Chickens and Their Eggs

There are a number of kinds of domestic fowls such as chickens, turkeys, ducks, geese, guineas, and pigeons, but the chicken is many times more numerous and valuable than all the other fowls combined. Chickens are divided into four classes: The Asiatic, Mediterranean, American and English. The Asiatic fowls have feathered legs and are large, slothful and poor layers. The Brahmas and Cochins are common breeds of this class. The Mediterraneans are small, active, nervous, without feathers on the legs and are the best layers known. Among the well known breeds of the class are the Leghorns and the Minorcas.

The American and English classes stand between the Asiatic and Mediterranean classes in size, activity and laying qualities. They are kept for both meat and eggs and are dual purpose fowls. The common breeeds of the American class are the Plymouth Rocks, the Rhode Island Red, and the Wyandotte. Of the

A Combination Milk and Beef Breed

Shorthorn cattle have slightly sloping backs, and legs and necks a little longer and more slender than those of the beef breed shown on the next page, but these characteristics are not so fully developed as in the pure milk breeds, such as Jerseys and Holsteins. Shorthorns are becoming very popular as general utility cattle because they are both milk and beef producers. Localities where dairying is in its infancy find the Shorthorn the most practical for the general farmer.

A Beef Producing Breed

Here is a champion Aberdeen Angus bull. The Aberdeen Angus have been trained by selective breeding to turn hay and grain into beef. The short, stocky build of the animals and accumulations of fat show this quality.

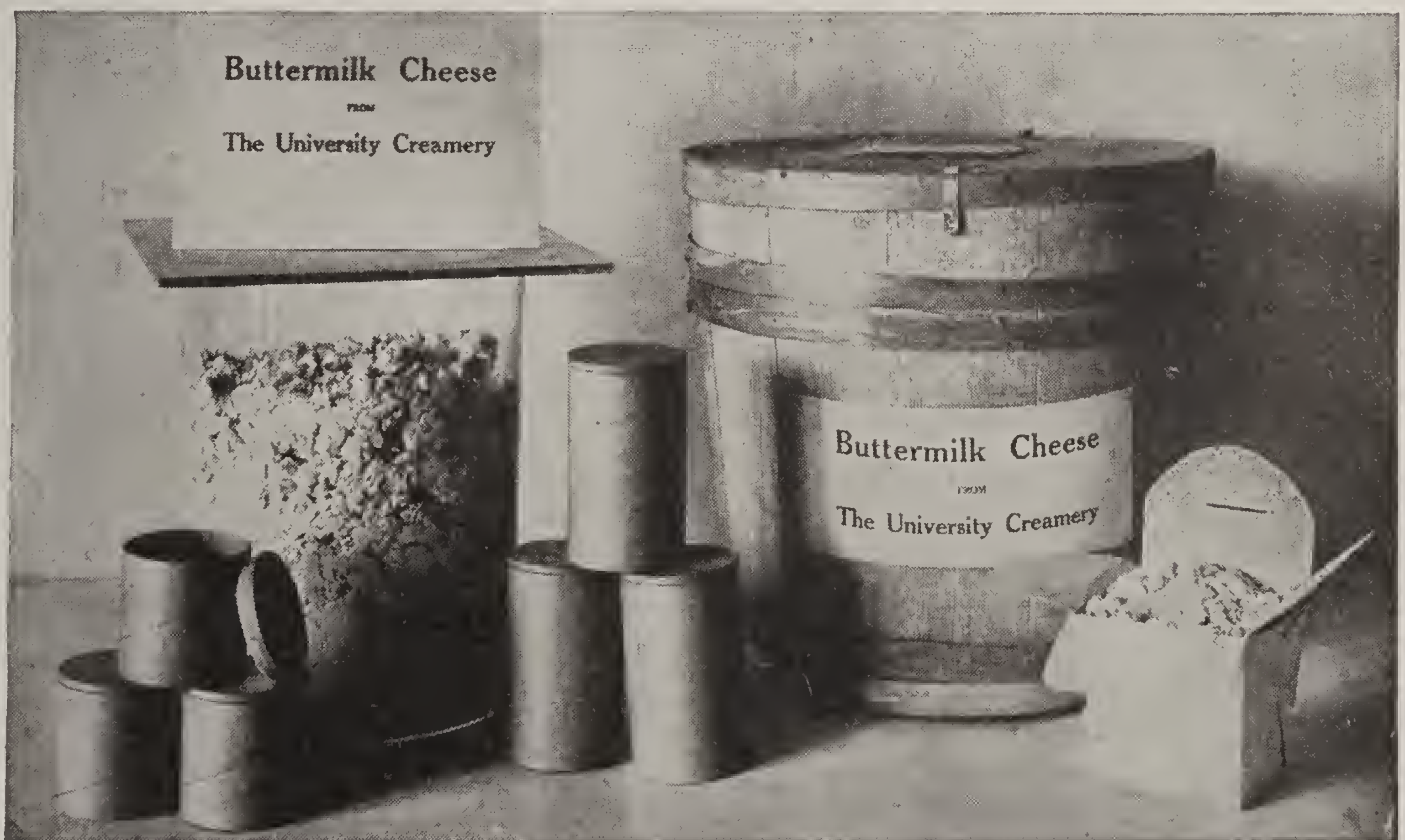
A Three-Year Old Record Breaker

The world's record in butter fat production was beaten by this pretty Holstein cow. Jersey and Holstein are the two leading milk breeds of cattle. Compare the build of the animals in this and the next picture with that of the Angus and Shorthorn.

A Jersey Mother and Two Fine Babies

Jersey cattle, the famous milk producers, are smaller than most other breeds. Their slender graceful bodies, creamy brown color and soft, intelligent eyes make them favorites with many people who have an eye for beauty as well as utility in their herds.

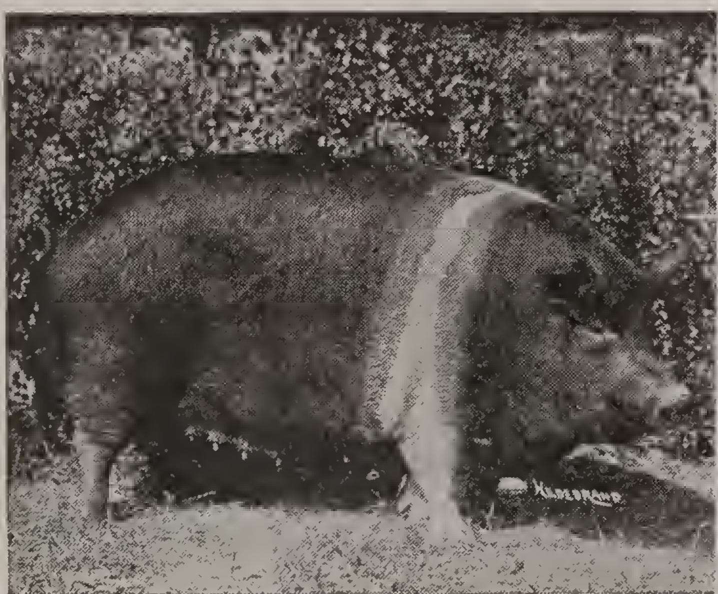
Making Buttermilk into Cheese



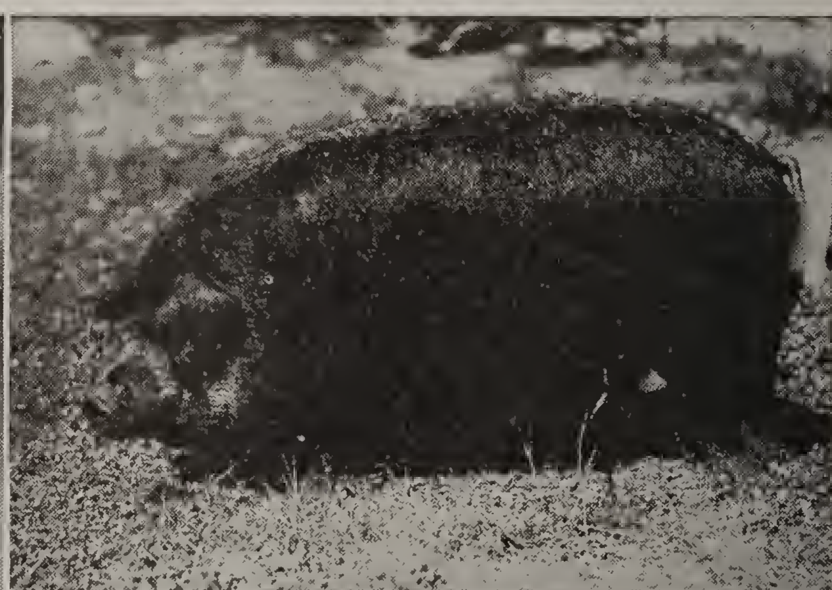
The University of Wisconsin has done much to help the farmer. This is one of the University's inventions, cheese made in the creamery from buttermilk. Buttermilk was a drug on the market in dairying localities, but because a satisfactory way of converting it into cheese has been discovered it is worth ten times as much as it was before.

The Pig Family


At the left is a wild boar, the ancestor of all of the many breeds of hogs. Wild boars were natives of Asia, Africa and Europe, and are not yet extinct. They were vicious, swift and powerful, but became domesticated early in the history of mankind. A few generations of care made the




animals more greedy and less particular in their choice of food and displayed their tendency to accumulate fat. The pig at the right is a good bacon-producing type—with long legs and sides. The two pigs in the middle of the page show the characteristics of both bacon and lard types. The

one with the white band is a Hampshire, a breed noted for its big litters. The dish-nosed specimen is a Berkshire. The last two on the page are true lard types, Poland China and Duroc-Jersey. Duroc-Jersey sows are better mothers than some other breeds.

The Hornless Shropshires

Notice the breadth of body of these sheep. They are Shropshires, long-wooled and good mutton producers.

A Rambouillet Gentleman of Quality

The Rambouillet sheep is really a branch of the American Merino breed. Its skin is loose, lying in folds that give more surface for the growth of wool. The wool of this breed is exceptionally fine and heavy. The tendency of Rambouillet sheep to stay together in one flock makes them especially suitable for farmers on our great Western ranges.

A School Garden in Toledo

"The best way to learn about plants is to grow them. If the pupils prepare the soil, plant the seed, watch the young plant burst through the soil crust, and unfold its leaves to the light and air; if they care for the plant throughout its life; and gather with their own hands the harvest, they will understand plants better than if they read about them or were merely told about them."

English class the Orpington is the only breed that is common enough to be well known in this country.

The School in the Garden

The Plants Themselves as Teachers

The best way to learn about plants is to grow them. If the pupils prepare the soil, plant the seed, watch the young plant burst through the soil crust, and unfold its leaves to the light and air; if they care for the plant throughout its life, and gather with their own hands the harvest they will understand plants better than if they merely read about them or were merely told about them. They would then know that the soil must be prepared for the seed; that the seed of each crop must be planted at the proper time and proper depth in the ground; and that each crop needs its own care and kind of season for the best yield.

The Seeds and How They Grow

The pupils would learn that most of the plants of the garden and field are grown from seeds but that some plants such as the potato, sugar cane, and the banana are produced from buds or eyes. They would learn that seeds which will germinate and produce plants are alive. In each such seed there is a tiny living plant folded up and tucked away between thick layers of food. It is upon this food that the tiny plant lives. When the seed is planted in the warm, moist soil it absorbs water and air and soon the tiny plant which may have been asleep

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White Leghorn Hens

It was a white Leghorn hen that broke the world's record by laying 303 eggs in a year. The Leghorns mature rapidly, are active, small and good layers.

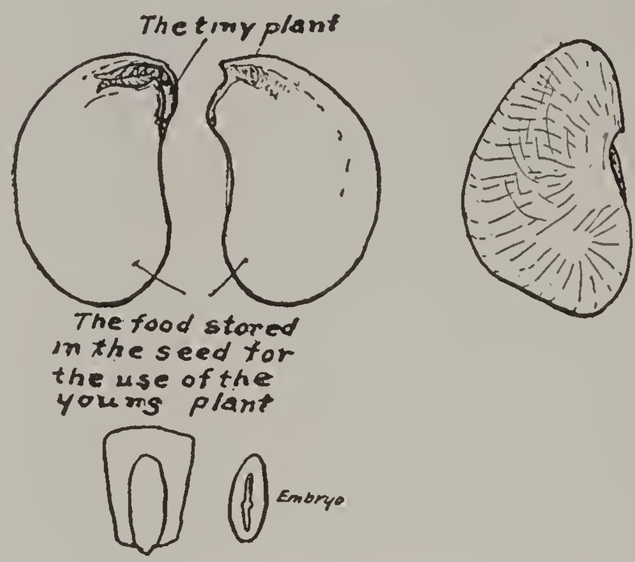
Feeding the Pullets

The barred Plymouth Rocks and Leghorns are probably the commonest breeds in this country. Plymouth Rocks are good layers, and are large enough to be used as meat fowls too. They make better mothers than the Leghorns.

for months and maybe for years begins to wake up and grow. The plant cannot yet draw any food from the soil for it hasn't any roots with which to take up the soil food and besides it hasn't any leaves in which to digest such food. Soil food must be digested and combined with air food before it can nourish the growing plant. The work of preparing soil food so that the plant can use it is done by leaves and only in the light. The seed food was prepared by the mother plant so that the young plant could use it without roots or leaves. So the plant must live on the food stored in the seed until its roots are formed and spread out in the soil and until its leaves are unfolded in the sunlight and air.

Then the tiny plant is ready to be-

How the Plant Begins its Life



At the bottom is the embryo of a grain of corn. The upper diagram shows how the young plant develops in a lima bean and the comparative size of embryo and food material stored in the seed.

A Carolina Poultry Club

The United States Department of Agriculture believes in teaching all branches of agriculture to the coming generation, not only making good farmers and farmers' wives of the future in this way, but also influencing the present generation of farmers, who will learn in no other way so well as by being outdone by their children. This is the Polkton Poultry Club of Anson County, North Carolina.

Garden Products

These are the vegetables, the crisp, fresh garden things that can be grown in almost any backyard in the country with a little care and cultivation. They are all familiar dishes on the American table, and heaped together they make an imposing array of garden good things.

gin housekeeping for itself, although it will grow faster and get along better if it can still have a little help from the seed for a while. But very soon all the food the seed contained is used up and the plant must get its own living. The plant can do this only if the soil was properly prepared before the seed was planted; if the rains come often enough to furnish the water for the growing plant; and if the children will do their part.

Helping the Plant Earn Its Living

After the plant is up, the children's part is to protect it against weeds. If weeds are allowed to grow they will rob the plant of its food and water and crowd it so that it cannot grow. Sometimes it will be necessary to protect the plant against robber insects which will cut it down or suck its juices so that it cannot grow. When all these things are done for the young plant, it will grow rapidly and will soon blossom and produce seed. When the seeds have ripened, many plants die and depend upon the tiny plant in each seed to produce other plants the next season. Corn and wheat are examples of such plants. They are called "annuals" because they live but a single year. Some plants live many years, as the alfalfa plant, the rose bush, or the apple tree. These plants are called "perennials" because they live more than two years.

A Beautiful Flower Design

This beautiful flower design was made by a high school girl on gray paper with wash and a little Chinese white. No forms are more beautiful than those that nature makes in flowers.

Learning to Draw

THIS is a big subject, for it really means art education. In whatever you undertake be sure to clearly understand that each of these things—drawing, design and color—is fundamental in a work of art and that all three may have an important place in even a single production.

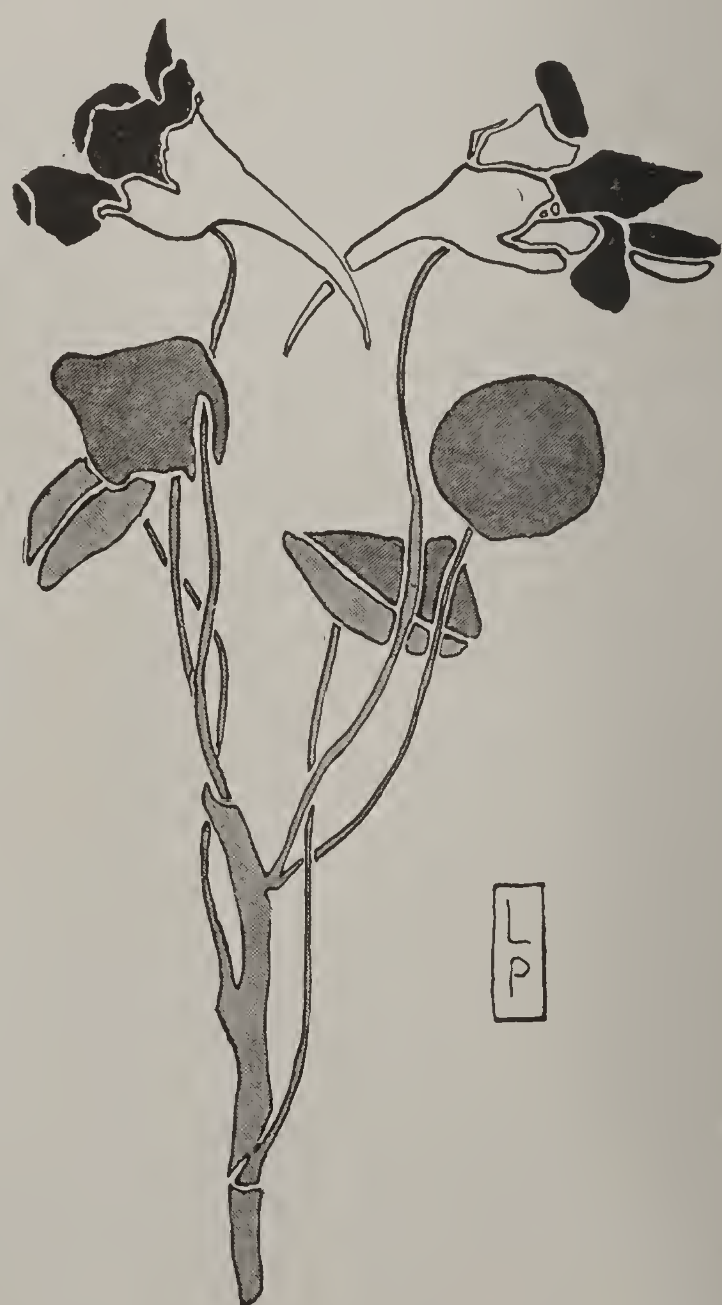
The Three Important Points

When we gain ideas from having seen certain things we often want to record them on paper. We can do this in one of two ways; we can either write the idea or we can make a picture of it. Of course, in the very beginning the first letters we learn, and which we now write so rapidly, were very carefully drawn, but as we only have twenty-seven different ones to make and as we spend so much of our time repeating them they become so familiar to us that we do not have to think when we draw them. We just write them.

In drawing we never have time

Simple But Beautiful Designs

These are simple but beautiful designs, further illustrating the grace and variety of form in our common flowers. Such designs are easily made if you first draw careful outlines with ink, then fill in the leaves and stems with a light tint of wash, and add a few blacks.



to become as familiar with the forms, they are so numerous and so different. But there are certain principles necessary in all drawing and when these are well understood we can draw almost anything. Then there are certain types of objects which we should know, so that we can classify our forms.

How to Hold the Brush

This is the proper way to hold your brush so that you can make your strokes slowly and carefully, yet boldly. The grass spray below shows result.

Three types of objects suggest themselves. They are plant forms, animal forms and manufactured forms. Nearly everything may be placed under one of these heads.

The Three Classes of Forms

Plant form or nature drawing includes the growing plants, berries and fruits, trees, vegetables and so on. We will first draw some of these.

Only a few materials are necessary; a camel's hair brush (No. 7), some black paint or ink, a pan of water, a blotter, a medium soft pencil (HB or B), and some drawing paper.

Small slender plants, such as grasses and sedges, are excellent for beginners in brush drawings, as a stem may be made with a single stroke. Bigger things, such as tree leaves and branches, fruits or vegetables, are adapted to pencil drawing, also.

The brush should be held almost vertically. You make wide or narrow lines with it by a guided pressure of the fingers. It is well to try the brush first on a scrap of paper to see what it will do. Good drawing can be made only after the use of tool or brush has become familiar to you.

A good plan to follow in drawing a nature spray is to:

First, note the movement of the growth and the general direction. Has it an angular growth like the clover or the wild carrot or is it curving and graceful like grass or the dog-tooth violet?

Second, note the branching and division of spaces. Where is the first change of growth? How far above is the next branching?

Third, note the proportion of parts. What is the relation of the size of the stem to the leaf and flower, if it has one?

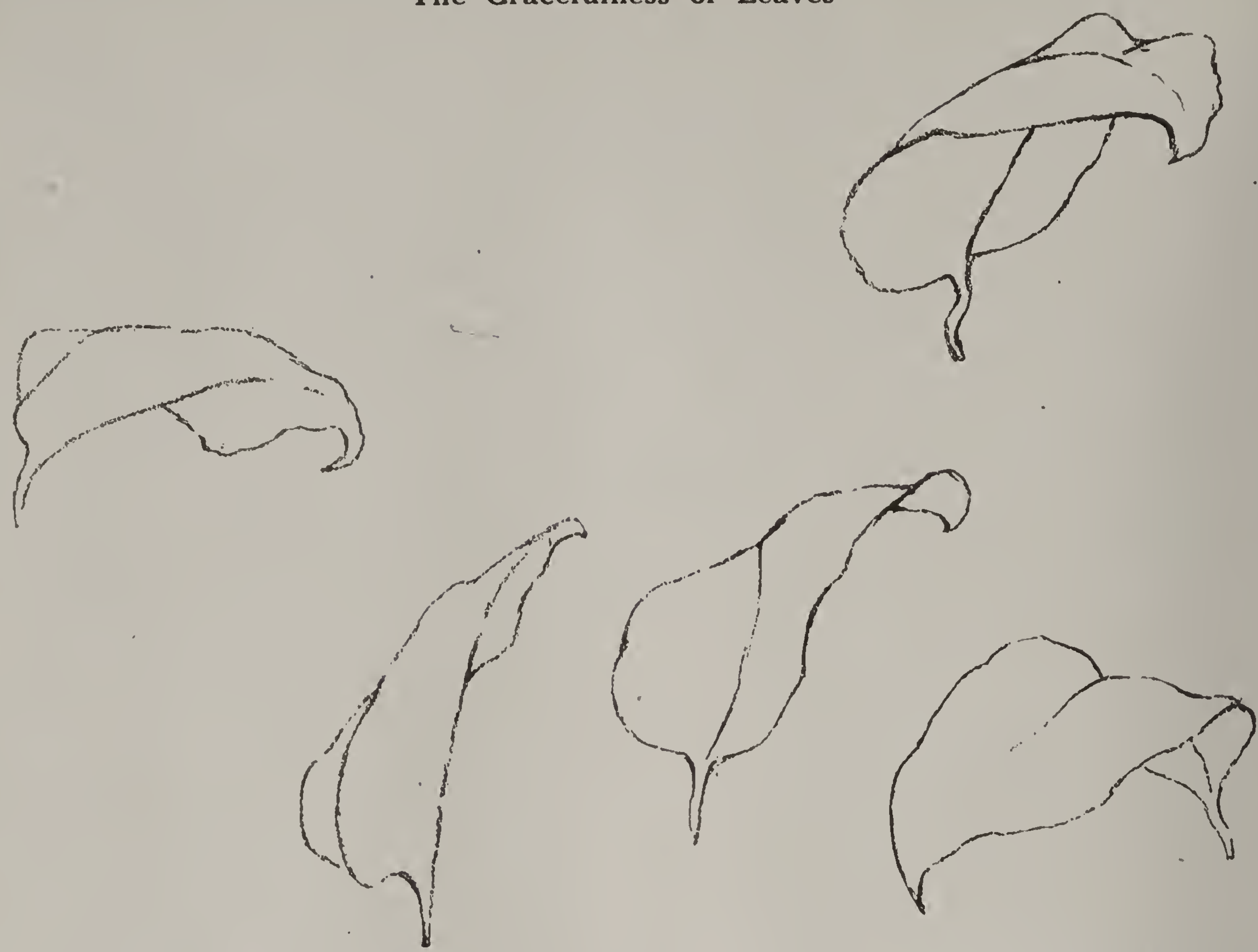
Fourth, note the foreshortening of parts, or the relative width of a leaf from front to back. Does it appear its true size and shape?

Fifth, note its construction and its joints. How do the stems and leaves attach themselves?

The spray may be drawn in one of two ways. It may either be sketched, very lightly, with a single line of the pencil to indicate the placing, and upon which the brush strokes will be painted, or it may be freely painted without aid of any kind.

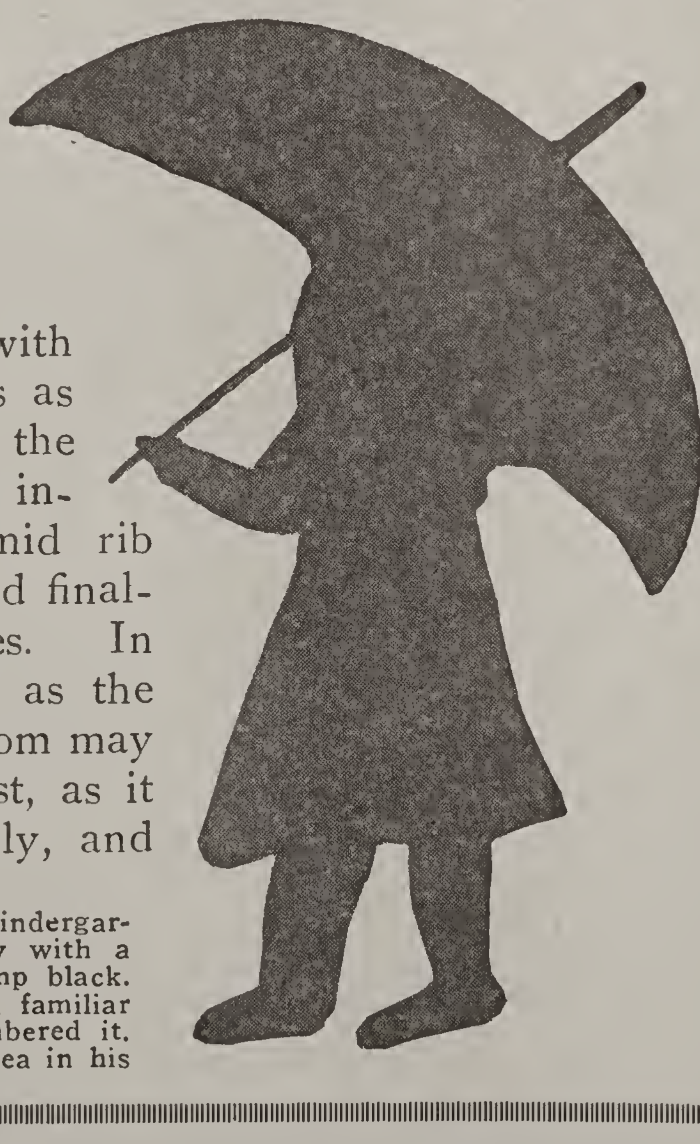
For this work the brush should be fairly wet but not dripping. The stroke should be made in the easiest, freest possible manner and when once made, it should not be altered or blotted out. In painting a spray of leaves the main stem should first

The Gracefulness of Leaves



This picture shows careful study of leaves by a pupil in the grades. You will notice she has added some accents which suggests the thickness of the leaves. In adding your accents be careful to put them only where shadows are darkest.

By a Kindergartner



be swept in with as few strokes as possible, then the branch stems, including the mid rib of the leaf, and finally the leaves. In such a flower as the tulip the blossom may be painted first, as it wilts so rapidly, and then the stem and leaves may be sketched.

First the objects may be made in flat silhouette. Not until the brush is a familiar tool should modeling or attempts at light and shade be made. Just how this is done will be taken up when we come

Here is what a kindergarten boy did simply with a brush and some lamp black. You see, he drew a familiar object as he remembered it. He expressed the idea in his own mind and was not "afraid of himself." Such drawing shows natural talent and should be encouraged by teachers and parents.

See What Toyo Did!

You know that art is an instinct with the Japanese. Here is an example of it in the work of a little Japanese boy named Toyo, in the Fifth Grade of the schools of Los Angeles. He did this with a brush and a little lampblack on cream-colored paper. He used the lampblack heavy for the stems, just a little heavier for the berries, and very light for the leaves. Notice that some of the leaves are darker than others, which shows they are more in the shadow.

to consider the subject of color.

In pencil drawing two lines must be used to show thickness. A single stroke as with the brush will not show a stem. The object should be lightly sketched in to get it placed and properly proportioned. This insures a working foundation so that as the drawing progresses there is less need to think of this essential placing. The various masses and shapes should then be carefully drawn and the joints searchingly observed. After all has been carefully rendered a few accents or slightly heavier strokes may be added. These should be made at some of the joints where little spots of shadow may be found and where parts of objects project toward the front. Only a few accents should be shown or the drawing will appear spotty.

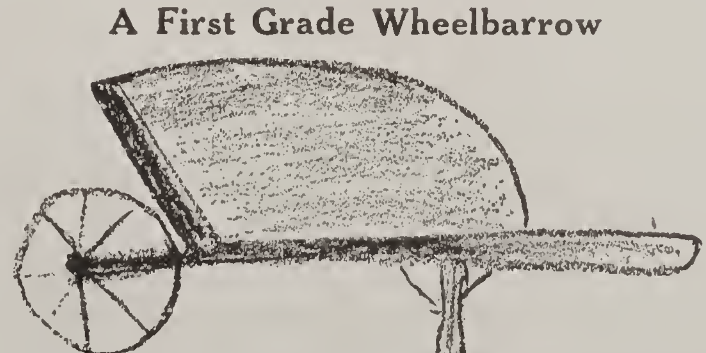
How to Draw Animal Forms

Just as in plant drawing so in drawing animal forms the structure of the object should be carefully observed. This foundation may then be clothed or filled in and the form will have strength or what we call character.

In the beginning the brush may be used to form a silhouette, thus bringing out the individual shape. Afterwards if the skeleton in action is sketched first the finished drawings will be more truthful and life-like. We know that every animal has a head, a neck, a body, arms and legs. Drawing a few skeleton figures helps to show the different parts in their proper relation to each other.

In drawing ani-

A First Grade Wheelbarrow



This wheelbarrow was made by a First Grade pupil with red crayon on a rough surface paper. To be sure, the wheel is not exactly round, but it shows the little artist knows just how a wheelbarrow is made.

How Things Are Made of Cubes

And now look at this funny object on the left. Would you think that was going to be a dog? His neck is a little too long and he is made of blocks, but, at the same time, you see the form of the coming dog. If you study objects you will find that every one is shaped as if it were modeled around a cube—it has front, back, top, sides and bottom. So a dog, for example, may be said to be simply a set of cubes rounded off at the corners! Whenever you start to draw an object, sketch in lightly the combinations of cubes which you can imagine underlying its outward form. Then the handling of the light and shade will be comparatively easy.

mals the following points should be noted:

First, that proper action, that is, the twist or turn of the skeleton, will insure a good final form.

Second, that always in the young form the various parts are rounder and fuller than in the older forms.

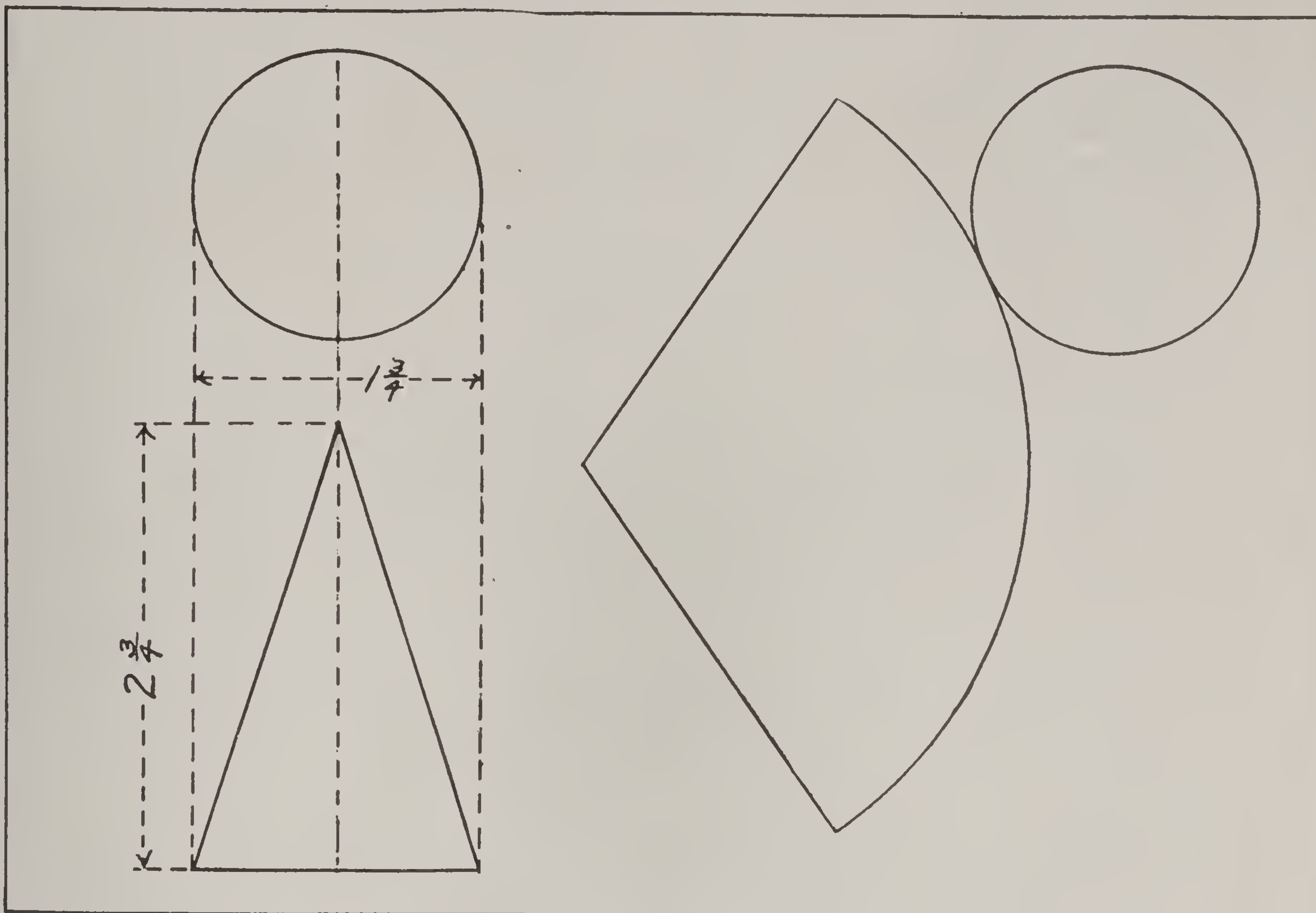
Third, that if you think of the animal's method of existing it is always easier to draw it. For example, a duck swims and so its legs are short, its feet are webbed and its body is built low with a heavy stern like a sail boat; but a hen walks on the ground and her legs are longer, her feet are stronger and without the webs, and her beak is pointed and sharp so she can peck at her food.

The pencil is a fine medium for animal drawing, and should be handled just as in the drawing of plant forms. A little colored crayon touched in after the drawing is made sometimes works up very effectively.

The Picture Language of Mechanics

There are two kinds of drawings commonly used in connection with manufactured forms. The word manufacture at once suggests one kind of drawing, the working drawing. This is a drawing made so that a manufacturer can work from it and reproduce the object drawn any number of times.

Working Drawing of a Cone



This is what is known as a "working drawing." It is the plan for a cone. The base is represented by a circle at the top, which you see is 1¾ inches wide. Below this is the side view, which shows that the cone is to be 2¾ inches high. The bottom of this side view is, of course, the same width as the base. At the right is shown a piece of paper cut out according to these dimensions. First make similar drawings on a piece of stout paper, and then cut out the parts and see how nicely they fit together.

Such a drawing may be made free-hand and is then called a shop sketch, or it may be made mechanically by the use of a T-square and triangles.

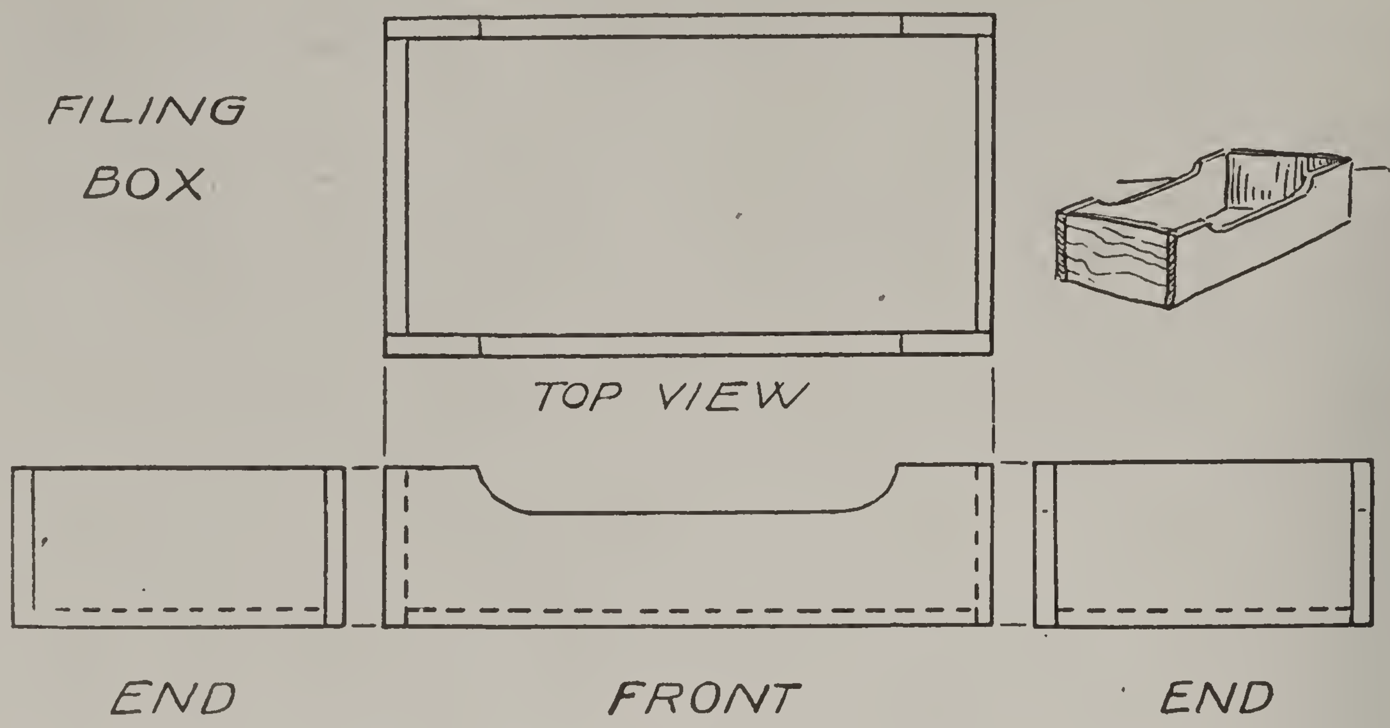
When a working drawing is made, separate and detached views showing only one side of the object at a time are given, but they are placed in a certain relation to each other. The front view, which shows neither side nor top, is usually placed beneath the top view, to the left of the right side view, and when this view is necessary, which is not often, to the right of the left side view. Then below and at the right of these views the figures or dimensions are placed. These show how big the object is to be made.

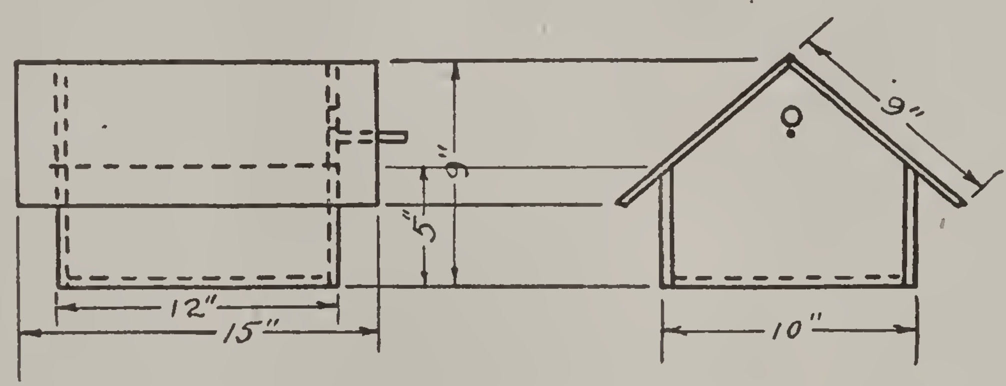
The working drawing is a most important form of drawing, as such drawings must always be made before any manufactured objects are constructed. Steps, posts, lamps, automobiles, houses, everything that is made in a factory or anywhere else requires a working drawing.

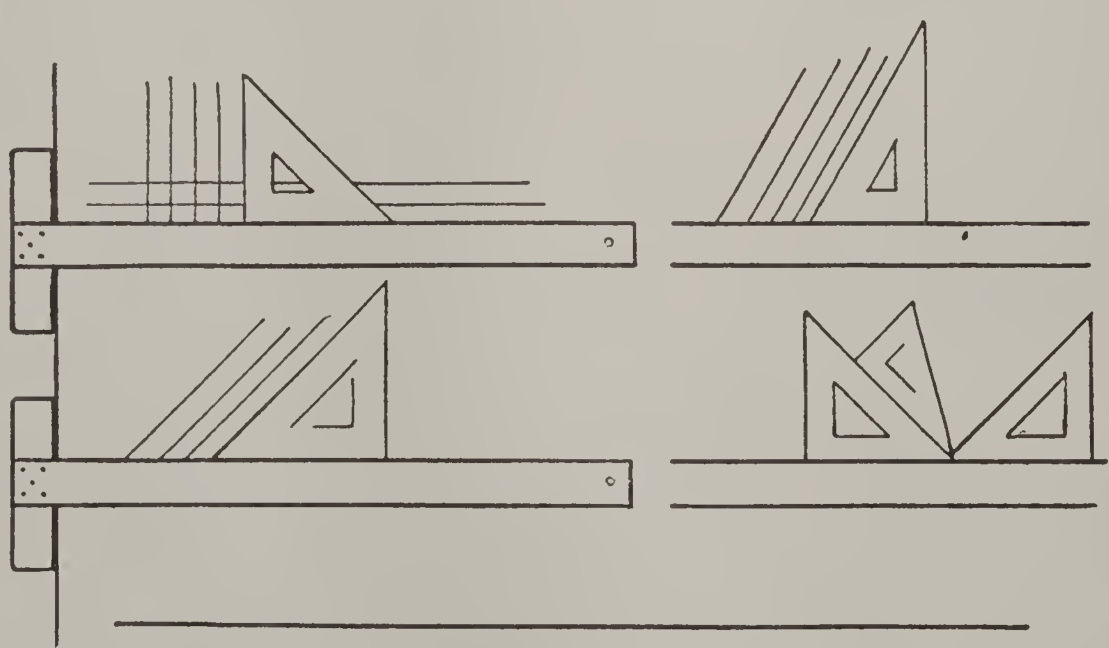
Importance of Working Drawings

Because they are so important certain lines and figures are always made in the same way in these drawings. The illustration will show these conventions and also the T-square and triangles. For mechanical drawings a fairly hard pencil should be used (4H), and all lines should be lightly drawn except in the finished work, when the lines showing the object may be heavier.

The paper should be placed by means of thumb tacks upon a smooth







Object Line

Invisible Edges

Extension Lines

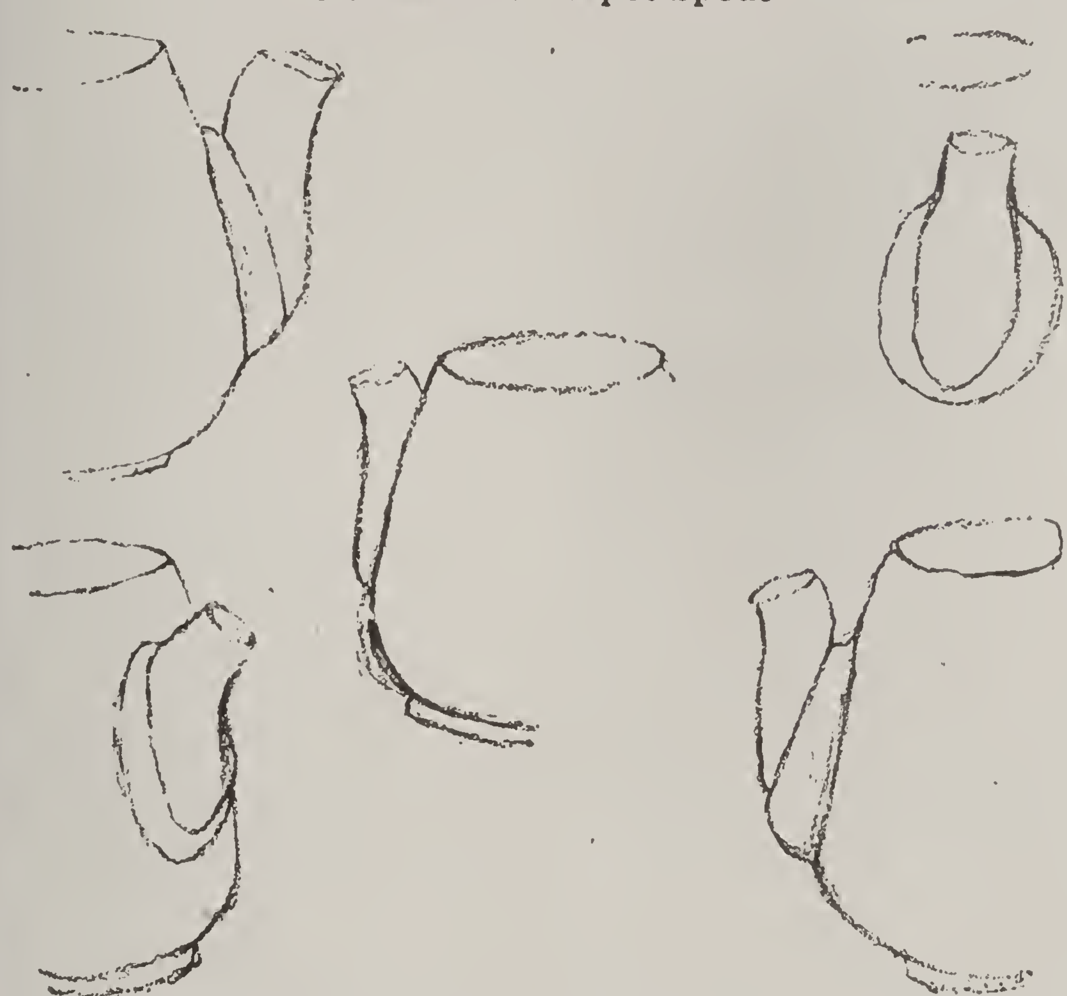
2'-4½"

Dimension Lines

How to Make Working Drawings

board which has a straight edge at the left side. The head of the T-square is then held firmly against this edge and run smoothly up and down the side as needed. All horizontal lines are then drawn against the upper edge of the T-square. The triangle always contains a right

Studies of a Teapot Spout



From these studies of the spout of a teapot you can see how to go about the study of form. Notice that the spout is studied from five different positions. By the time you have made this number of studies of such a simple object you should be able to draw it, with fair accuracy, from memory.

angle. One side of this right angle is placed on the upper side of the T square and all vertical lines are drawn against the other side of the right angle. In this way all lines perpendicular or at right angles to each other may be quickly and accurately drawn. For curved lines, of course, compasses are used.

In mechanical drawing the following things must be noted:

First, everything must be accurately drawn, that is, parallel lines must always be parallel, lines must meet at corners without overlapping, distances and measurements must always be exact.

Second, only what is necessary for the workman must be drawn, yet at the same time nothing essential to him must be lacking.

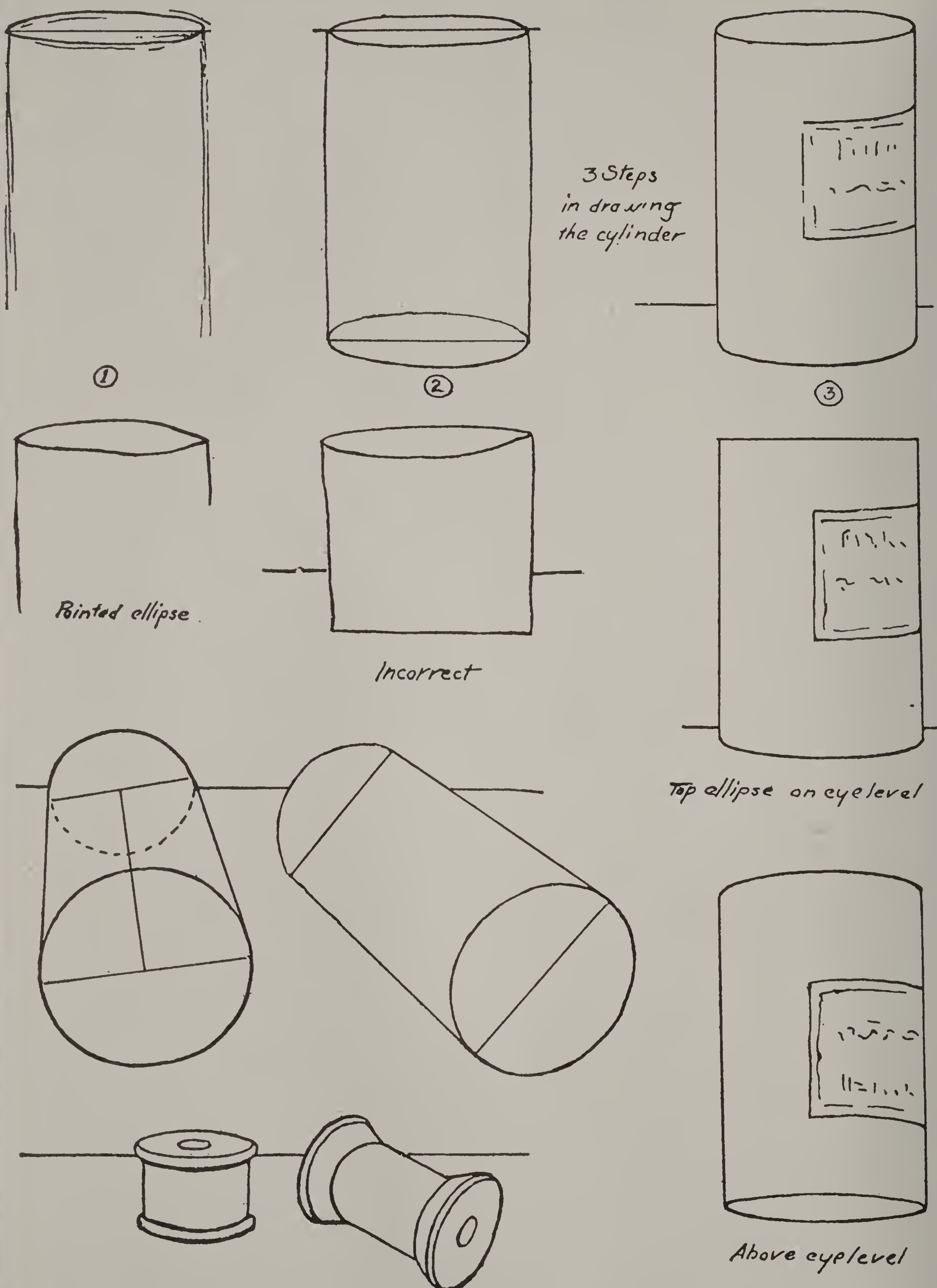
Making Pictures of Manufactured Things

The other kind of drawing from manufactured objects is like our nature and animal drawing and is called representation. The very first may be made flat, showing only the shapes. These may be filled in or they may be left in outline. The object must be carefully observed as in our previous drawing and then all its characteristic shape should be represented. Following this we may try for more truthful representation.

Unlike mechanical drawing we seek to picture an object as it appears to the eye. To do this we must understand what are termed laws of perspective. These laws are only necessary in the representation of thickness or depth. Therefore, while unnecessary in the working drawing because the separate faces are drawn, they are very essential where two or three sides or faces of the object are shown in a single drawing, as in representation.

Roughly, manufactured objects may be divided into classes, round or cylindric forms and rectangular

How to Draw Cylindrical Objects



These photographs show you how to draw different objects of a cylindrical shape. One of the difficulties in drawing a cylinder in certain positions is to represent the ellipse correctly. A common mistake is in making it pointed at the sides. Try first drawing the ellipse itself, then add the sides, as in Figure 2. Then erase all of your construction lines, put on a bottom, and you have a cylinder as shown in Figure 3. After you have practiced drawing a can at different elevations, try a spool, as shown below, which gives you the problem of several ellipses fitting together. Little as you might suspect it until you try it, this is a rather difficult drawing to make.

forms. Cylindric forms of plain shape are simple objects with which to begin.

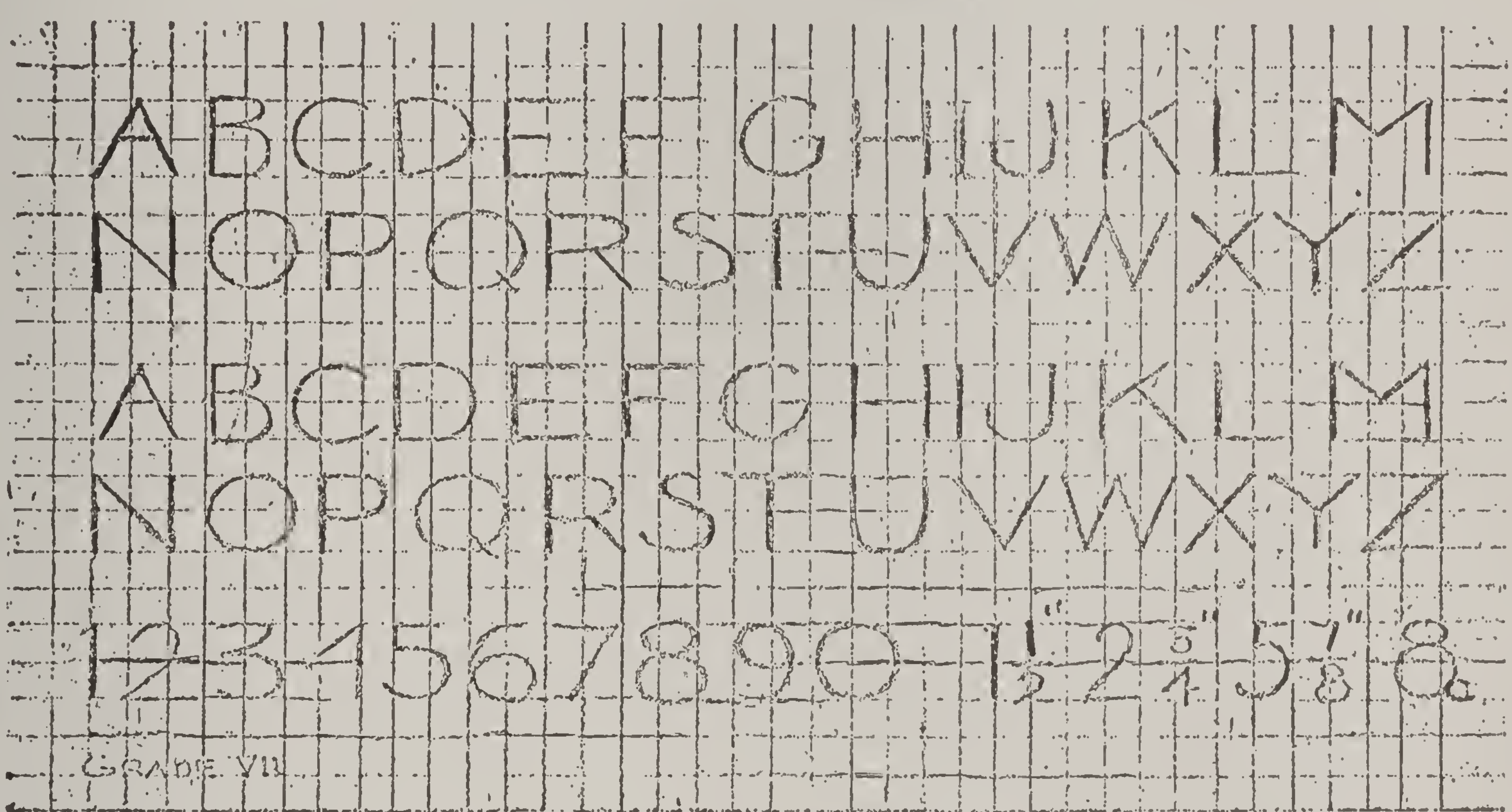
The common objects found in the home, such as kitchen utensils, serve as excellent models. An ordinary glass cup or jar is good. This should be placed in front of you so that you can see partly into it. The sides, you will notice, appear as straight

Fine Models in Your Kitchen

If the object is raised so that the top circle comes on a level with the eye you will notice that it then appears as a straight, horizontal line. As it is still further raised the ellipse appears again but this time the front edge curves upward.

In drawing the object it may first be roughly located. Then the top ellipse may be lightly drawn just as narrow as it really appears. The

To Improve Your Lettering.



Square off some paper with a pencil and try these free-hand letters, making them fit into the squares, as shown. After you have practiced this a while you will find that the lettering you do looks much neater than before. Our illustration is an example of commendable Seventh Grade work.

vertical lines, but the top and bottom which you know are actually circles look like ellipses with the front edges curving downward. You will also notice, if you look carefully, that the bottom ellipse, or the ellipse which is farther from you, looks a little wider from front to back than the top or nearer one. This fact is very important and if once remembered you can draw any cylindric object without looking at it. And this holds true whether the object is on its side or end for the ellipse which is farthest away always appears widest.

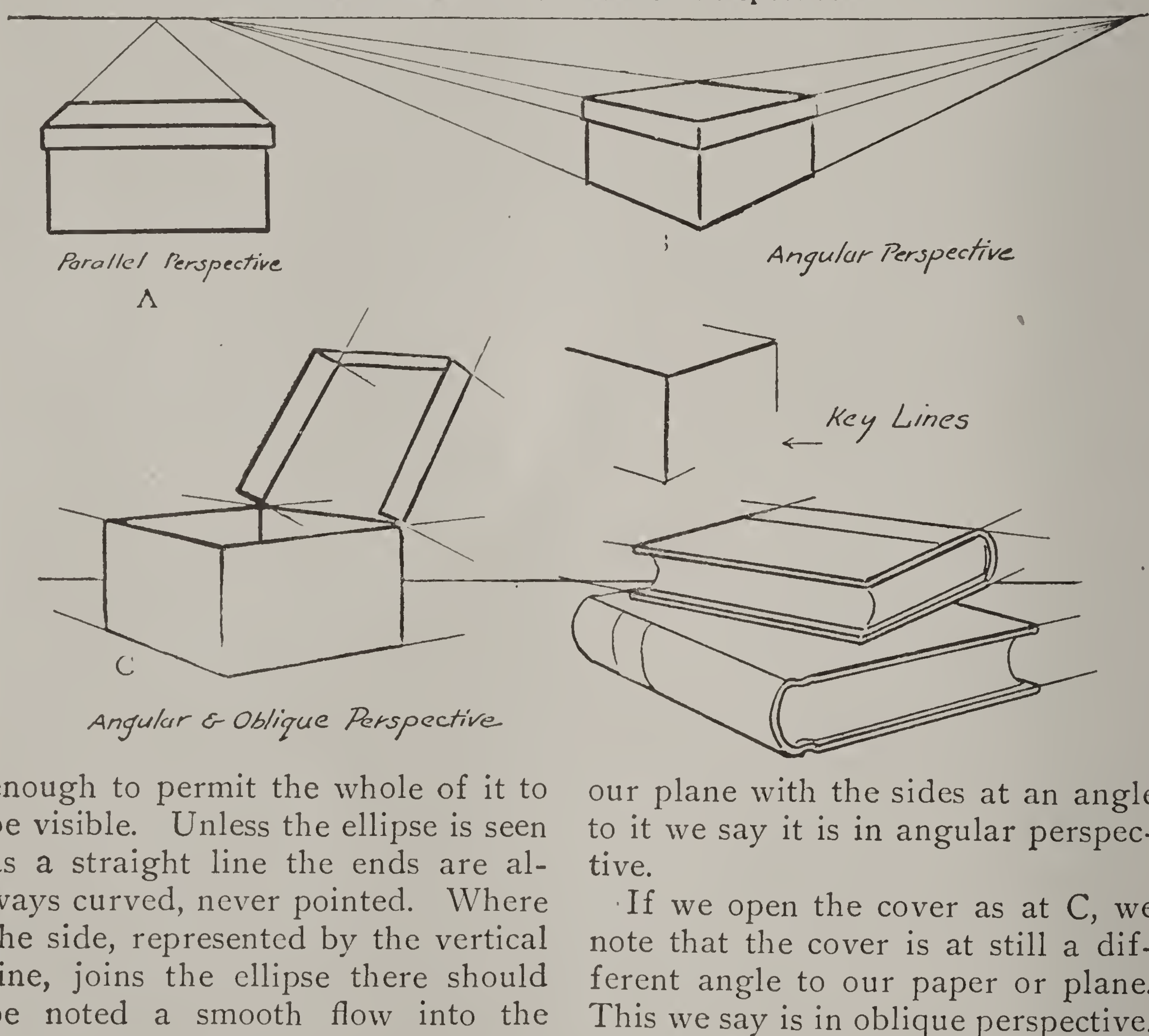
sides may now be dropped from the ends of the ellipse, always being sure that they are kept straight and parallel. All this is much more quickly drawn than written. In fact, this first sketching, done ever so lightly, should be accomplished in half a minute at most.

Sketching Should Be Rapid

After the top ellipse and the sides are sketched the lower ellipse is lightly suggested. The drawing should now be tested. Are the ellipses too narrow? Does it seem to fill the paper well or is it too small? Is it too tall or short?

When these questions are answered the corrected lines may be gone over with a heavier stroke and a slight accent where the curves of the ellipses come toward the front. This tends to emphasize the third dimension or thickness. Of course the lower ellipse shows only the front half unless the object is transparent enough to permit the whole of it to be visible. Unless the ellipse is seen as a straight line the ends are always curved, never pointed. Where the side, represented by the vertical line, joins the ellipse there should be noted a smooth flow into the curve of the ellipse—never an angle. These points are important and are constructive features to be followed in any cylindrical object.

Illustrations of the Laws of Perspectives



What a Box Can Teach You

Rectangular forms offer new perspective elements which must be observed. A simple box is shown in two positions, A and B. A shows only two faces and is said to be in parallel perspective because its front is parallel to an imaginary plane placed between the eyes and the object. To simplify matters we might consider the drawing paper this plane and on that we represent the object. B shows three faces. Because the corner is pointing toward our plane with the sides at an angle to it we say it is in angular perspective.

If we open the cover as at C, we note that the cover is at still a different angle to our paper or plane. This we say is in oblique perspective.

Any simple box is a good object with which to begin drawing. At first it may be placed in the position of A. Note first, as in all representative drawings, the general proportions. Is it too long? Too short? Too deep? Then note that the back edge is shorter than the front edge. Therefore the side edges must slant

Questions to Ask About Your Box

in as they retreat. There is another reason for this slanting or convergence. If you look down a long straight street or railroad track you will see how the sides of the street or the steel rails appear to come together. You will note also that if they were carried on and extended they would appear to meet on a level with the eye, or at the horizon, which is always at the eye level. So in the box the sides of the top which retreat from you appear to converge to a point on the eye-level directly in front of the eye.

The Great Law of Perspective

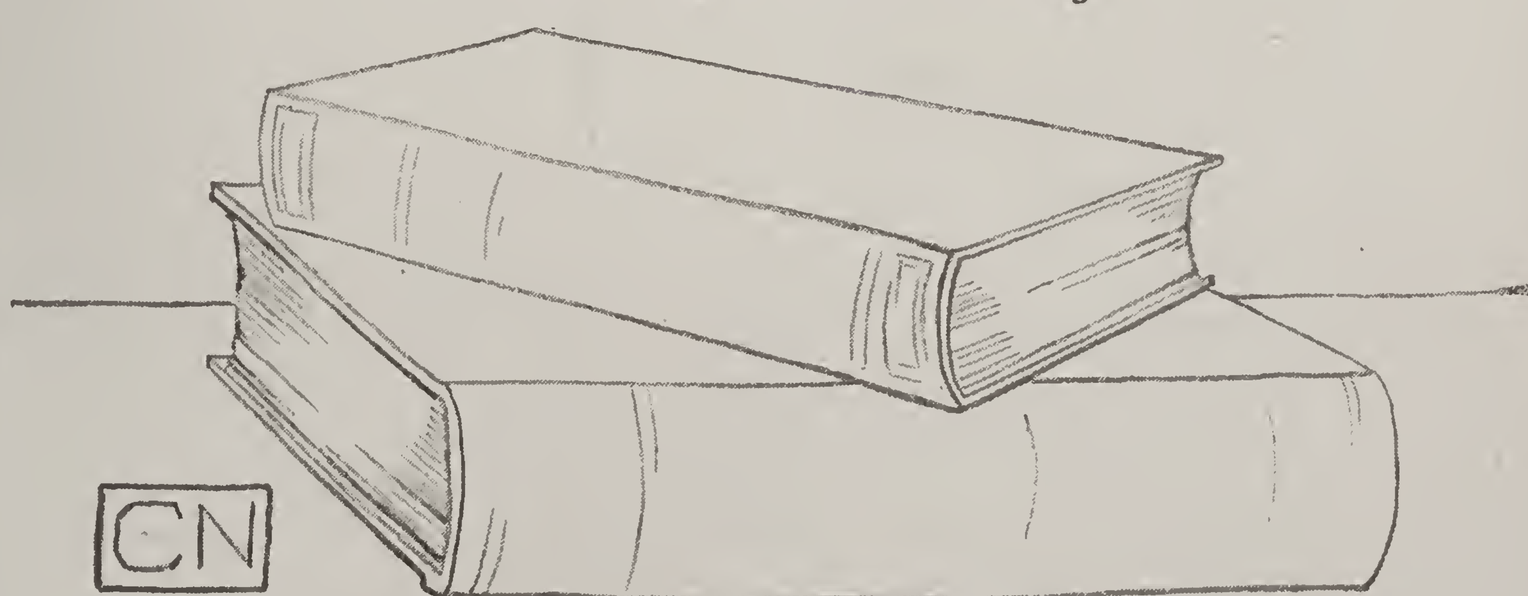
In B, however, the sides retreat to the left and to the right, yet they, too, converge to points on the eye-level. Notice here also that the base lines of the box slant up and converge to the same points at the right and left. There are then three pairs of visible lines on either side of the front vertical edge and they are all parallel. As they all appear to converge at the same point we can formulate this very important perspective rule—*all parallel horizontal and retreating lines appear to converge to a point on the horizon or eye level. When the lines are below the eye they slant up to the eye level; when they are above the eye they slant down to the eye level.*

Remembering this it is a simple matter to draw almost any rectangular object. Always in beginning the drawing of the rectangular form the three key lines should be sketched first. Then the other lines are easily added, but always make it a point to show the slight convergence necessary.

How to Deal with Group Figures

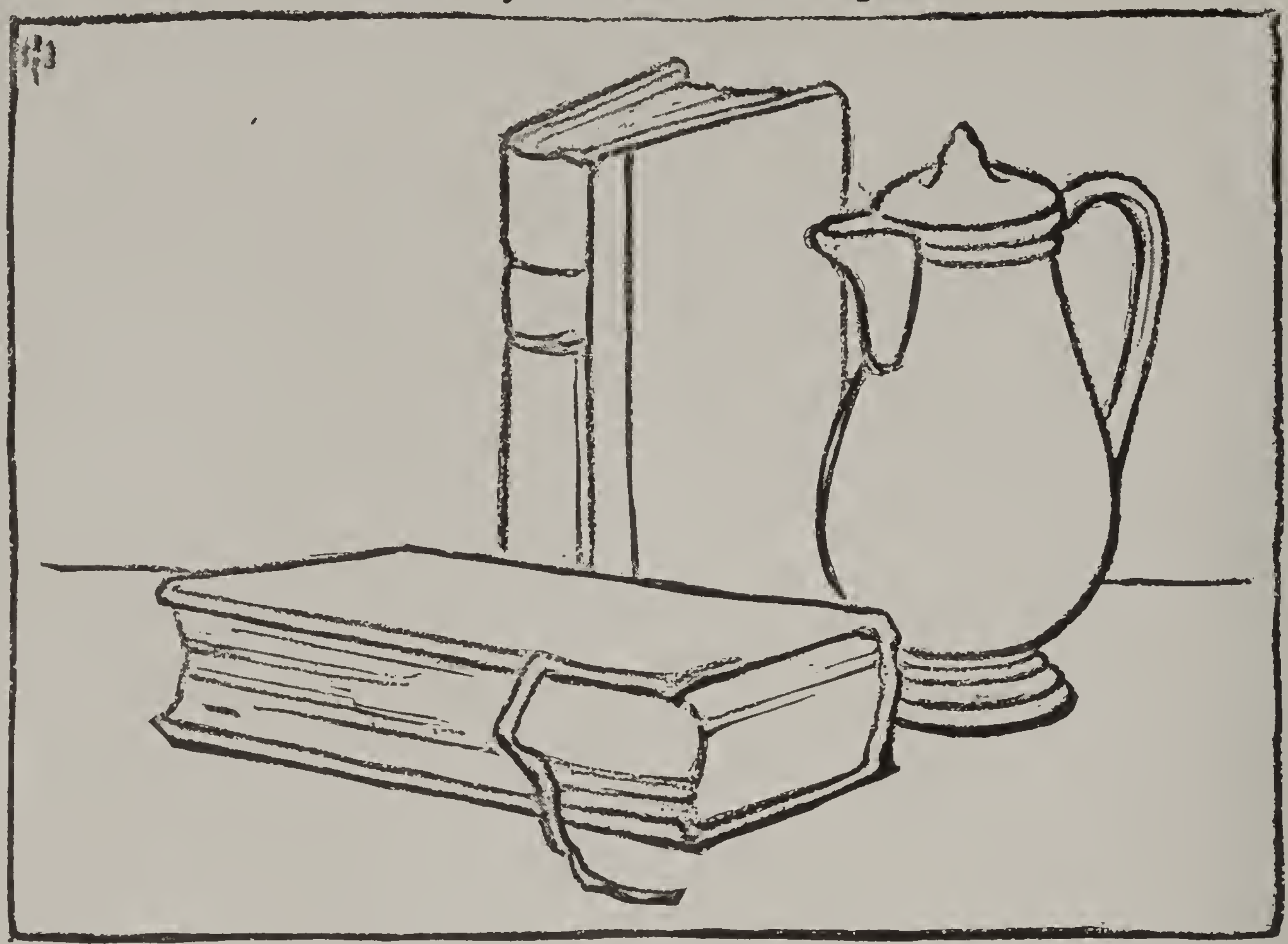
The last point to be considered is grouping. In drawing the group it is well to consider it as a whole and place marks to indicate the highest, the lowest and the widest parts first. With very light lines block in the group and the individual objects. A careful test follows and when all has been carefully scrutinized the lines are drawn much heavier but with thoughtful precision. The nearest lines may, as a rule, be slightly heavier than those farthest away. Of course two objects can never be in

A Little Problem in Book Drawing.



After you have grasped the principles of perspective from the picture on the opposite page, take a couple of books and try drawing them as this boy did. See if you can make them look as if they were lying on the table and as if one side were just as long as the other. Then put in a few accents, and you will have quite a professional-looking drawing. The two letters in the corner are the signature of the young artist. But there is another reason for putting them in just that place, and that is to give balance to the picture.

Some Cylinders and Rectangles



These illustrations show common objects of cylindric and rectangular shape, suggesting general constructive features, as thickness, proportion, etc.

Illustrations of Accented Outlines

Here are some more complicated objects of the common type, showing accented outline. This drawing is more complicated than the preceding and you should not attempt it until you have mastered smaller and simpler objects.

Art and Green Peppers

Here is a very good sketch of a green pepper. The outlines have been followed very faithfully. You can see the person who made this was not afraid of getting a line in the wrong place, but, having had practice and knowing what she could do, went at it boldly, and the result is these simple, strong expressive lines.

the same place at the same time, so in our group the object nearest us must be lower down on the paper.

Law of Harmony in Grouping

Good groups show some variety in form, though never too much. A tall bottle and a pill box are not a pleasing group, because of the great contrast. Two or three oranges and a bowl, or a book and a candlestick are usually good.

The illustrations show some possible groups and also a simple treatment of shading. In shading with the pencil simple, direct and thoughtful strokes, following the general direction of the surface and suggesting part of the shadow only, are

The "Feeling" in Lines

In all your sketches try to feel that you are expressing yourself on paper; go right after the lines as if you meant business. Make them light or heavy—just as you feel they should be. In your accent lines bear down just as hard as you want to on your pencil. In most of the drawings shown here the pencil pushed through the paper where the heaviest accents were made. Whenever you think best put a little border around your picture. This will often make it look better, just as the borders around the pages of this book improve the appearance of the book.

quite satisfactory. Never rub the shading and never seek to put all you may see in the drawing. Just the stronger notes with accents at joints or points of contact are sufficient.

A Conventional Design

Here is what is called a conventional design. It was made by a student for a spring program at school. Notice how simple it is and at the same time how well balanced and pleasing.

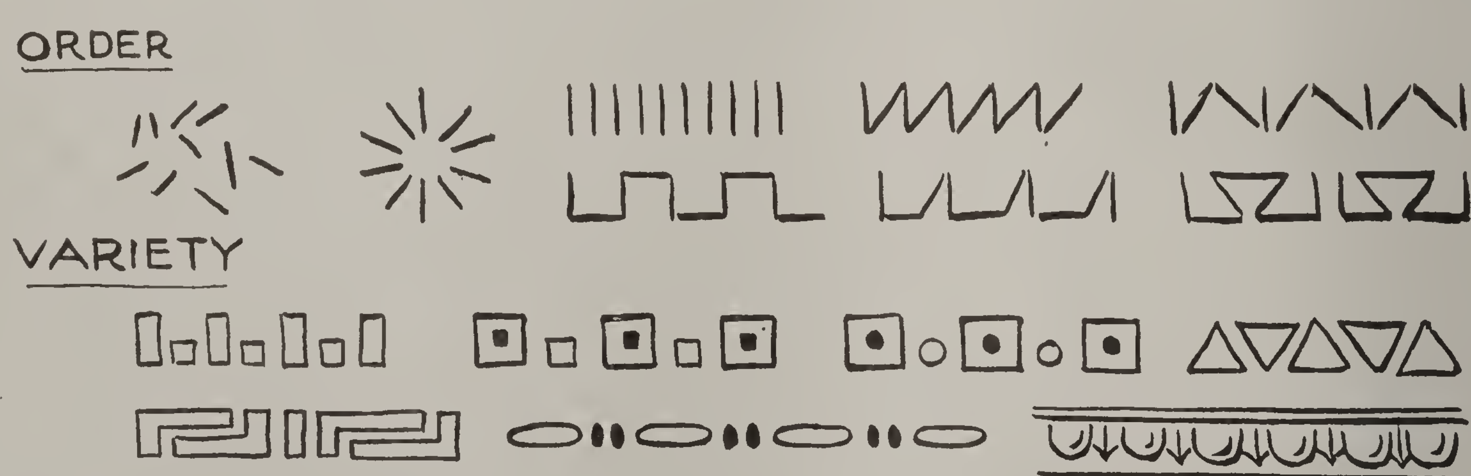
The Principles of Design

When a person makes something to meet his particular need we say he designs it. And likewise when decoration is added or applied to its surface we again use the term, saying that he has added a design. Design, then may be divided into two classes, Constructive Design and Decorative Design. The one deals with the form and function or use of an object, the other deals only in surface ornament. Therefore a chair, a table or a paper-knife is an example of constructive design. A poster, a bookcover or a piece of carving is an example of decorative design.

The Two Forms of Design

Underlying all good design, whether constructive or decorative, are certain fundamental or first principles which are quite essential. In order to know how to design it is important that these principles be studied.

The first principle is *Order,* the very first law of the universe. Any good design must be orderly. A few lines or spots scattered at random are not good because there is no order, but arranged in a systematic fashion the result is a more or less pleasing design. You will see immediately, then, that any decoration which is good requires this orderly thinking and development.



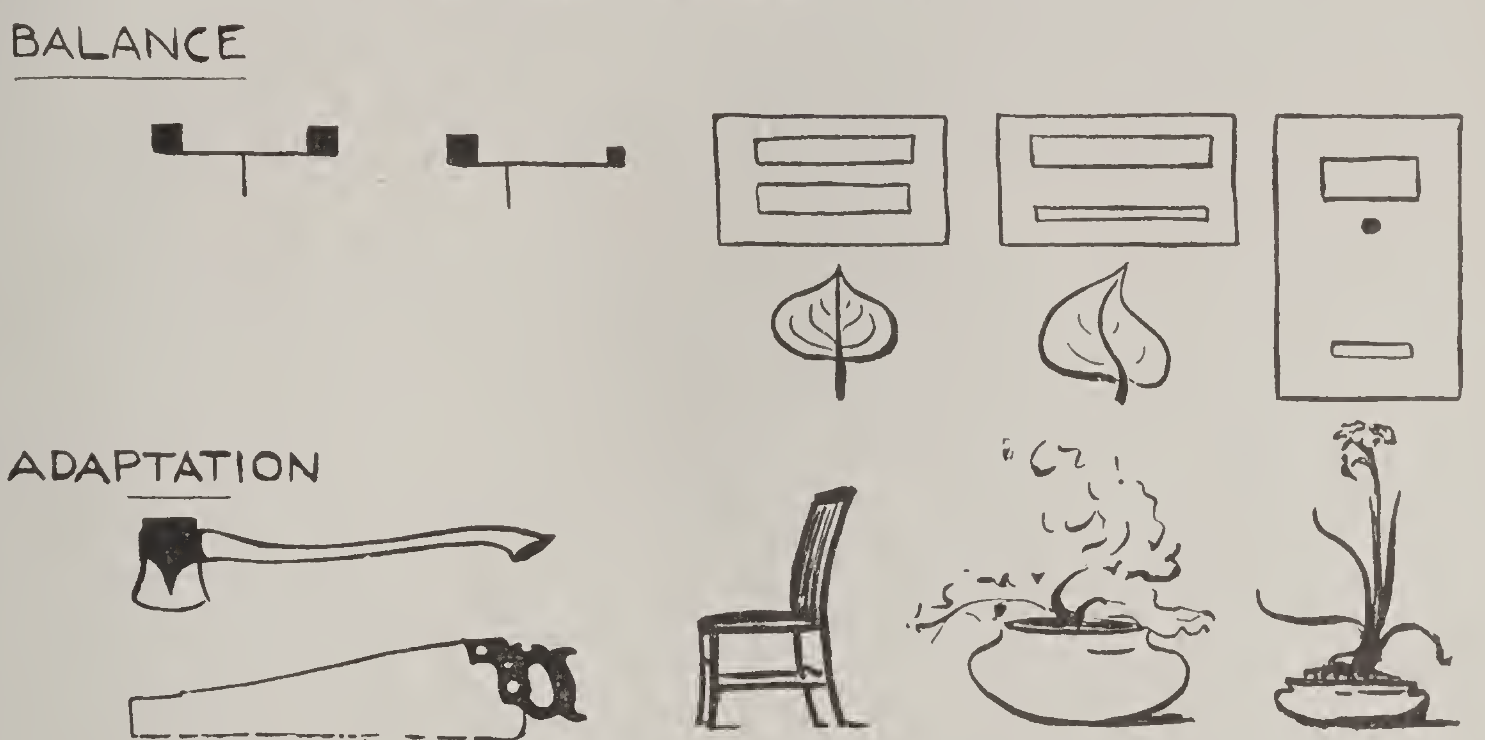
Examples of Order and Variety

The second principle is *Variety.* We may have an orderly arrangement of lines or forms but it still may be uninteresting and monot-

onous. A good design will always show some measure of variety or change. It may be ever so little yet still afford more pleasure than would be found without it. The lines used to illustrate the principle of Order may be varied and while keeping to an orderly arrangement the effect is doubly attractive.

Necessity of Variety in a Good Design

Examples of Balance and Adaptation.



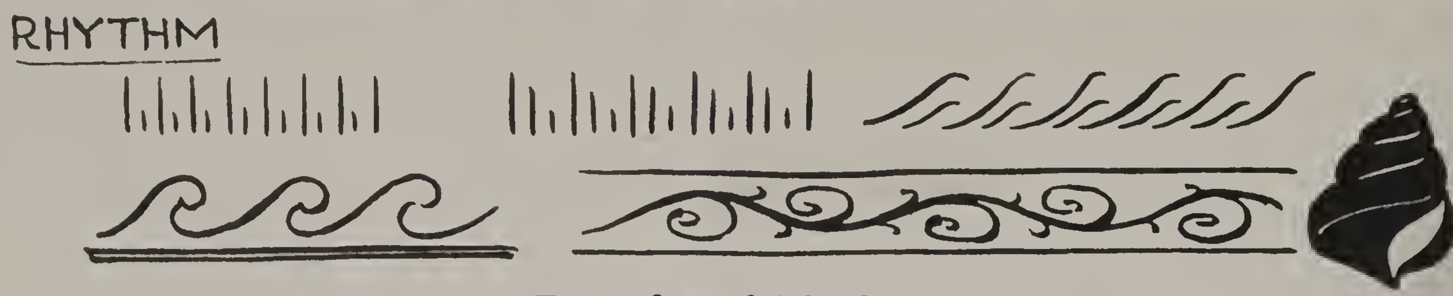
The third principle is *Balance.* All good designs are well balanced. There are two kinds of balance; the balance of equal parts or bisymmetrical balance, and the balance of unequal parts or occult balance. The latter is a balance which is observed and determined largely by feeling. The principle is best illustrated by the common "see-saw." Equal weights will balance at points equally distant from the pivoting point. Increase the weight of one end, providing the pivoting point remains at the same place, the larger weight must, in order to balance the smaller one, move in nearer the pivot.

The "Pivot" of a Picture

Designs which are not borders nor repeated patterns covering unbounded areas, such as wall papers, usually have their pivoting or balancing point which is always in or near the center of the decorated space. Upon this imaginary though important pivot all the parts and colors of the design must balance. A bisymmetrical design, where the left half is identical, or nearly so, with the right half, only requires adjustment between the top and bottom so that the weights above and below, balance near the center of the space. This is comparatively easy. But where the decoration or arrangement of masses is not bisymmetrical it requires careful and thoughtful judging and estimating to make sure of proper balance.

The fourth principle is *Rhythm.* Beautiful designs have a swing or graceful movement similar to that found in poetry or music. The lines illustrating Order are more or less rhythmic because there is a movement from one to another but when Variety is combined with Order and there is a distinct accented movement, we have Rhythm. Rhythm is found in the repetition of lines, masses and colors and in single lines

The Rhythm of Poetry and Pictures



Examples of Rhythm

and curves.

The fifth principle is *Adaptation.* This is perhaps the most important principle and immediately determines whether a design is good or poor. Adaptation includes four important things:

Principle of Adaption

(a) The shape must be adapted to its purpose.

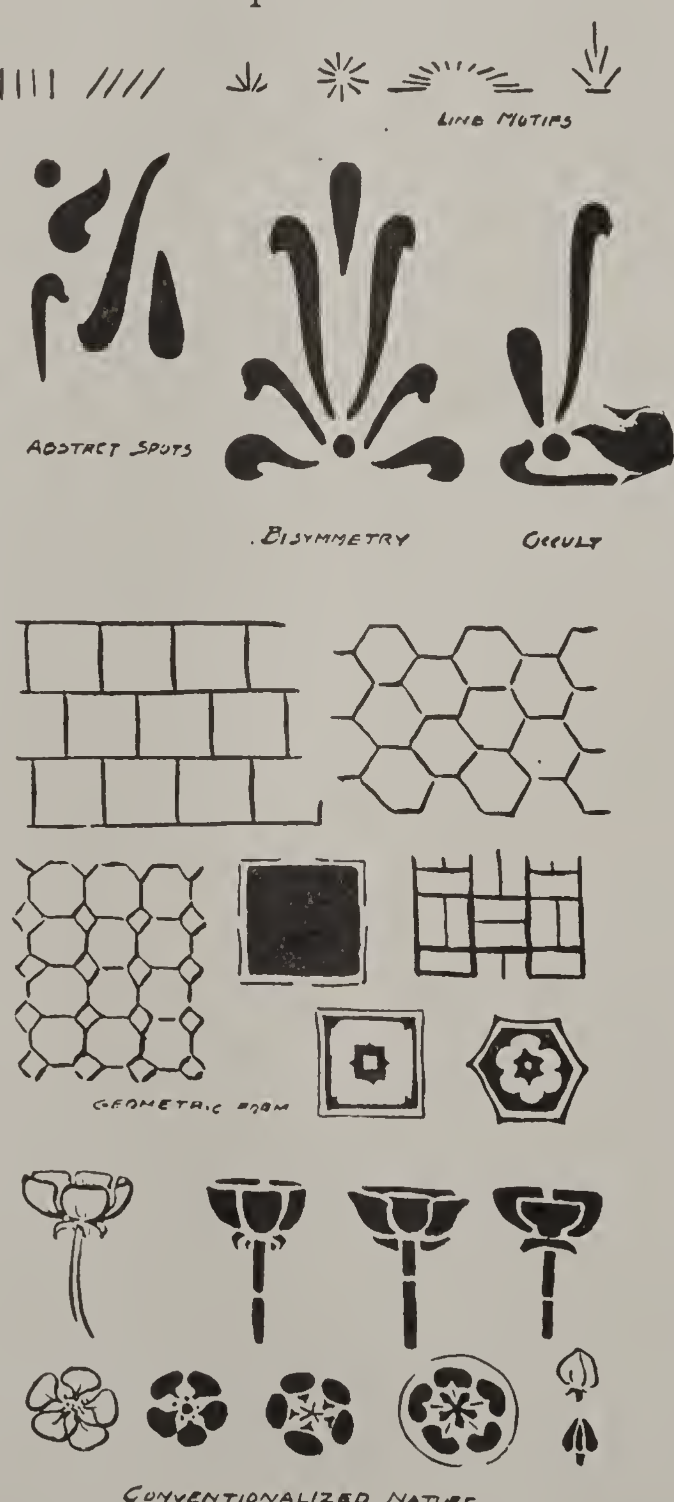
(b) The material must be adapted to its use.

(c) The construction must be adapted to the material.

(d) The decoration must be adapted to the material, the construction and the space.

Every design demands one or all of these requirements depending upon the kind of design. (a), (b) and (c) concern only constructive design and (d) applies only to decorative design.

There are otner principles of design but these five are sufficient for the problems we will consider. In good designs all five may be found supplementing and aiding each other to make the result not only a good design but a beautiful one.

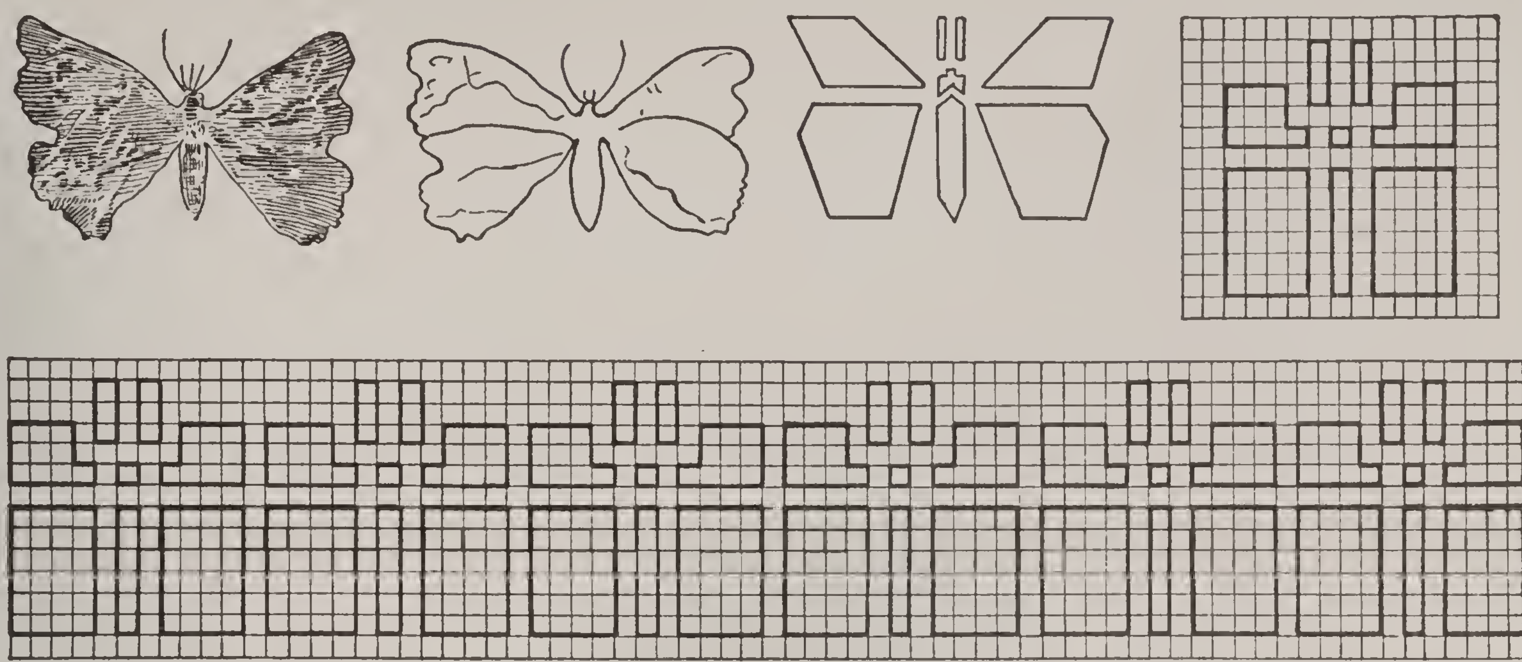


"Handsome is as Handsome Does"

In constructive design the purpose or use to which the object is put determines its general shape, style and construction. In decorative design, however, the problem is different. Something must be used as a decoration and just what it shall be is not so easily determined. It may be a line, a geometric shape, an abstract spot or a conventionalized nature form. These are called motifs of design. The line may be used as inlay in a box, the geometric shape may be applied to a floor, the abstract spot may be pleasing on a curtain and the conventionalized nature form may adapt itself to a wall paper.

We will first try to work out some of these motifs. With the pencil or brush, lines may be quickly made. They may first be placed in vertical rows, then slanted, then tied together in simple shapes. A few abstract spots may be made on a sepa-

A Conventional Design



Squared paper is a great aid in making conventional designs. Here a pupil has made a sketch of a butterfly. Then he has simplified it and kept on simplifying it until he has the conventional design shown in the squares.

rate sheet of paper, painted and then cut out. These black spots may now be shifted and arranged to form a pleasing bisymmetrical unit and one with occult balance. By using five different spots varying in shape and size an interesting game may be played.

The geometric motifs consist merely of the common forms such as the square, the triangle, the pentagon, the hexagon, etc. These may be used singly or united in pleasing surface designs. The boundaries of such forms, their centers, their corners, their diagonals and their axes may be greatly varied, often with most delightful results.

Nature As a Source of Design

Mother Nature as an Artist

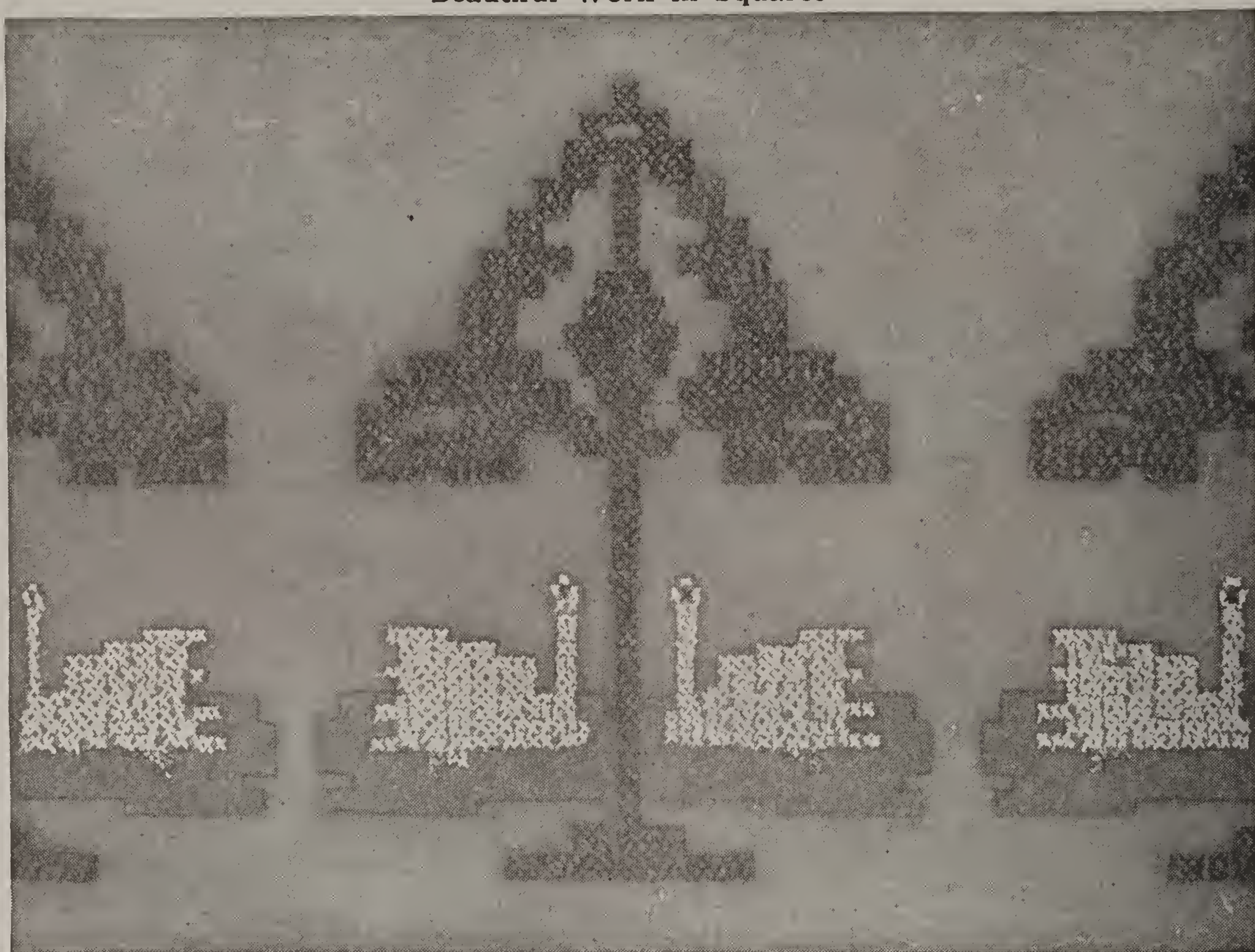
One of the most common sources of design motifs is Nature. She is so wonderful, so orderly, so varied, so balanced, so rhythmic and so well adapted to her purposes; in fact, she shows all the principles of good design so beautifully that designers have gone to her for their designs since the beginning of time.

Good design never allows nature to be imitated and exactly copied. But when used for decorative purposes we must simplify her and conventionalize her. This means that we are subduing her freedom and are placing her within certain bounds and limits. The more formal and dignified and sober the purpose of the design, the more restricted and conventional must the nature motif become. For example, a cover design for a school report would be more conventional than a design for an Arbor Day program.

Steps from Nature to Convention

When we conventionalize we must never lose the big characteristics of the flower or form and its growth. In conventionalizing a few careful drawings should first be made directly from the natural specimen. Then, after noticing closely the growth and individual form, we may simplify by keeping boundary lines simpler, by separating parts or by enlarging spots. A second step may follow when the various parts may

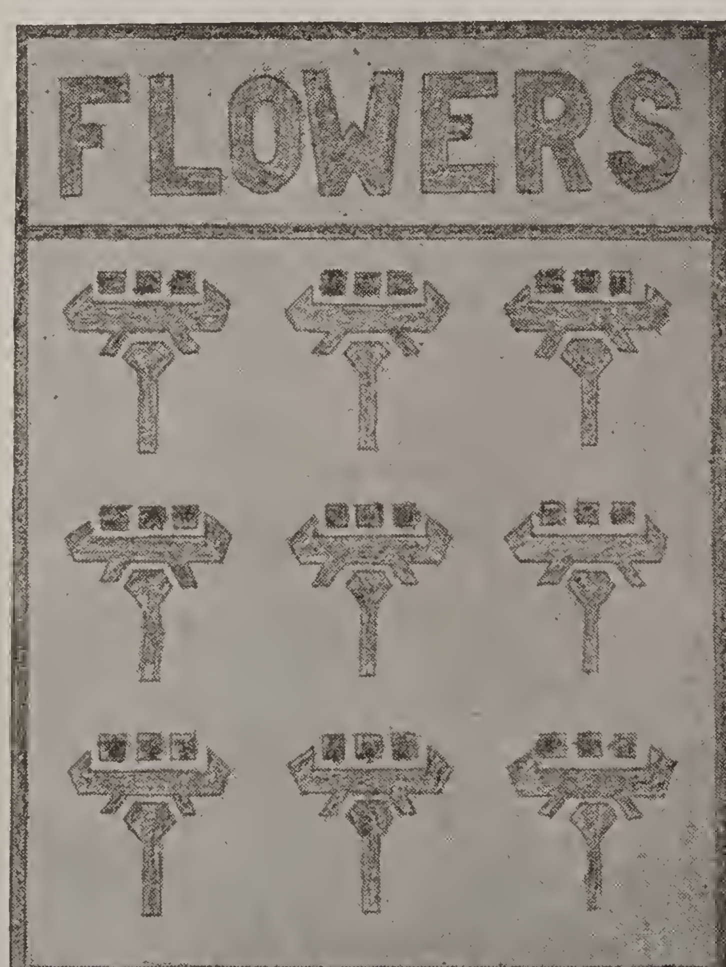
Beautiful Work in Squares



Isn't this a beautiful design made up of squares? It is done on yellow paper with pencil and some wash and a little white. Of course, these are not true pictures of swans, but, at the same time, it is quite clear that a swan was used as the foundation for the design. So with the design of the tree. These figures, constantly repeated, make a very tasteful border decoration.

be slightly changed or still further simplified, but all the time keeping to the character of the original form.

The various design motifs are always results of thoughtful effort on the part of the designer. They never come without considerable trying so it is wise never to get discouraged at first results. Just keep at it and soon something good will begin to appear. Then follow it up and finish it.



This is the cover design of a little booklet made in school. It contains a composition on flowers.

A good way to begin to design is to use squared paper. This paper has lines running across the surface at right angles forming little squares. Interesting units and motifs can be worked out in a bisymmetric arrangement or an occult balance. It is fun to draw a bird or some animal in the squares,

How to Spell with the Color Alphabet

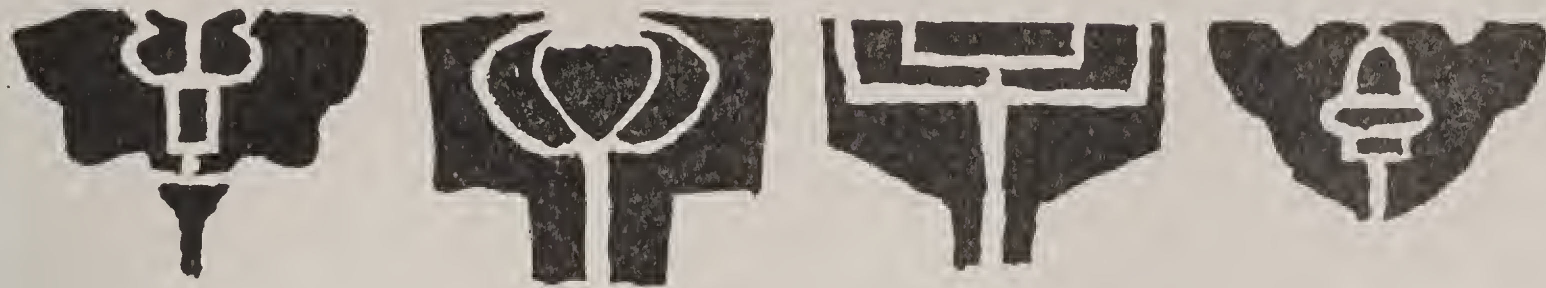
You know the whole world of words is made up of only twenty-six letters; but did you know that the alphabet of the world of colors has only three letters in it? With the primary colors—red, yellow and blue—in various proportions and combinations, nature and the artists "write out" all the wonderful color messages they bring to us.

This color chart illustrates how the primary colors are combined to make new colors, just as letters in words are combined to make new sentences. Red and yellow, equally mixed, give

orange; yellow and blue, green; red and blue, purple. The second row of blocks shows how the colors are mixed. You put a block of red paint alongside a block of yellow, for example, and then, while they are wet, by a zigzag movement of the brush, you mix them. The last block on the right shows how all three primary colors are mixed to produce what is called a neutral tone, which is used in representing the colors of the bare ground, tree trunks, and so on.

The picture below shows how the artist uses colors in making a landscape composition.

Wood Block Designs



These are different designs suitable for wood blocks. They are made from a study of flowers.

always being sure to use squares and not curves to make the figure.

Now for Constructive Design

A constructive design will be our next problem. Perhaps a paper cutter will be good. The first point to think about is its purpose. It is to cut the leaves of a book or open envelopes. Therefore it must have a handle and a blade.

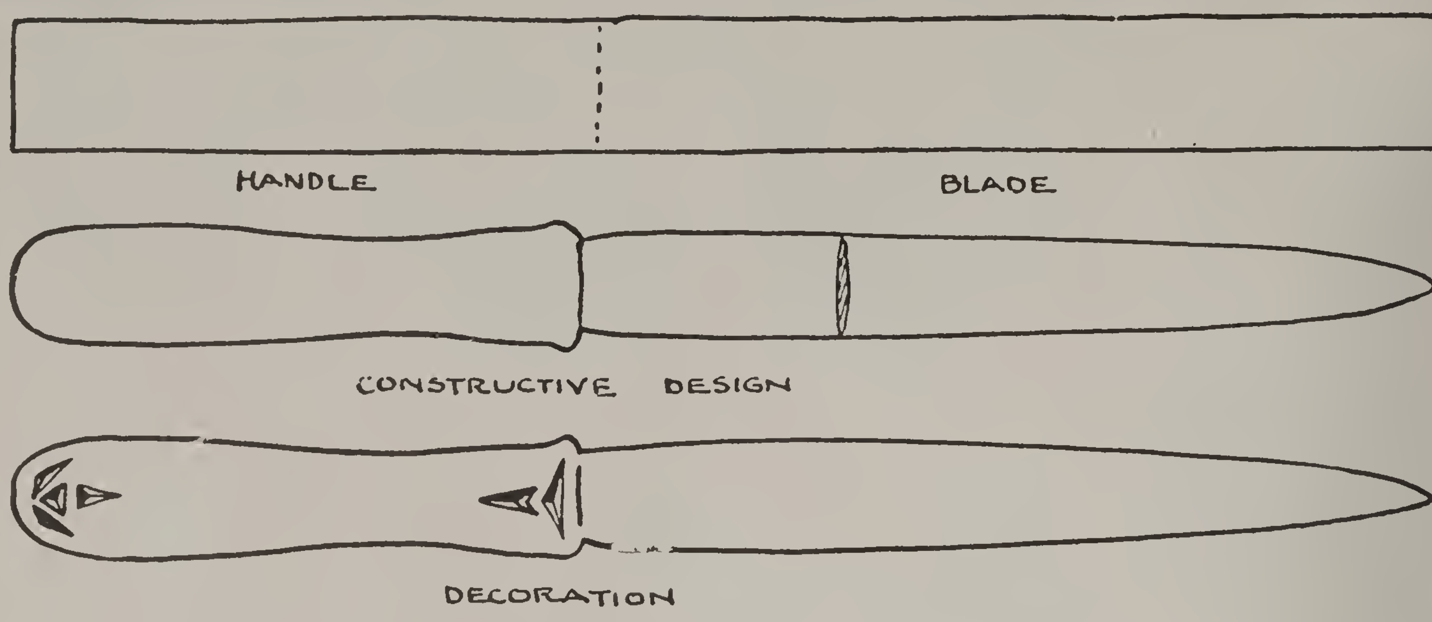
The next thing to consider is the material of which it is to be made. Shall it be metal or bone or wood? Let us select wood as it is easy to cut and it is light. The next point is size. Of course it must not be very large for envelopes are not large and it must not be too small or we could not handle it. Our hand, then, gives us a clue as to its size. Naturally the blade will be a little longer than the handle and so we soon arrive at seven or eight inches as a suitable length.

A Cover Design

Nature is closely copied in this design. In such work, if you think a flower would look better in a different position, make it so, being careful to have the general character of the plant correctly represented.

The next question is the shape. It should feel good to the hand which grasps it; it should be rounded on the handle so that there will be no sharp edges. The blade should be thin and wedgelike so that it can slip between paper. It may have a long curved edge, as it cuts better.

At this point we can begin to make sketches on paper. And now we must think of some of the principles. Unconsciously we have been considering Adaptation but now we can consider Balance, Rhythm and Variety. The knife should balance well in the hand. Its lines may be varied and at the same time rhyth-



DESIGN · FOR · PAPER · KNIFE

mic. So gradually the design appears and after refining and purifying the lines and shapes we produce a more or less beautiful piece of constructive design.

Design for Decoration

Having designed a paper knife we may now think about still further beautifying it. Can we decorate it and if so, how? Again we must consider the material. As it is wood it can not be enameled or pierced as could metal. It may, however, be carved or burned or inlaid or merely polished. Let us consider carving it. This means that the design is either to be cut into the wood or left while the background is cut away. The illustration shows both methods. The first is the simpler after the design is once thought out. On such a small object the design cannot afford to be elaborate. Therefore, a simple line effect or small abstract spots may be adapted.

A decoration must never hide the construction of an object, so the design must necessarily follow the general outline or emphasize the purpose or use. It may emphasize the handle, the joint between handle and blade, or the blade.

One other example will be sufficient to show how designs are worked out. This time we will plan a book plate. A book plate is a label to be pasted inside the cover of a book, which tells the owner's name and has some decoration to show what he likes or is interested in. This decoration may be a book and candle or some animal, a flower, a landscape, a boat or some other interesting thing. It also contains the Latin words Ex Libris (meaning, "from the library" of the owner) or the words His Book, as well as the person's name. Sometimes a short poem is added. In fact, a person may use most anything he chooses and the problem for the designer is to arrange these things in a pleasing decoration. We will use in our plate the violet, some books and an ink-well, with an old-fashioned quill pen.

Appropriate Things in a Book Plate

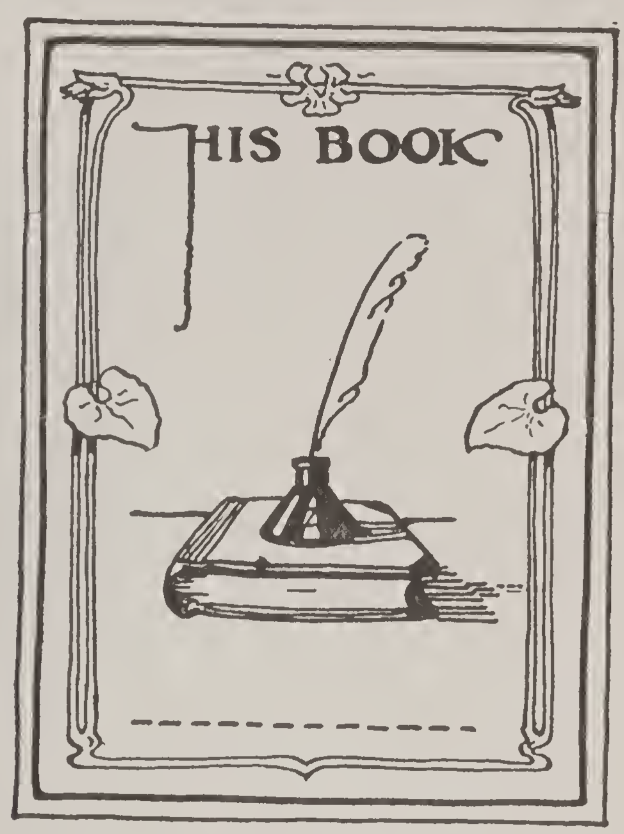
The first thing to consider is the size of the plate. As it must go in small as well as large books, three inches by four inches will make a good size. The next thing is to consider the method of making it. As we need a large number of the same

book plates, we will have them printed and that means that the drawing will be sent to an engraver who will make a zinc plate from which the prints are made. As he would prefer a drawing larger than the final print, because when made

Sketch

smaller by the photographing machine it is greatly improved in appearance, we will make our design just four times the actual size for the book. A large drawing is also much easier to make. We must now make some sketch notes to block out an idea for the design. The name may be at the top or the bottom, the violets may form a border or we may have straight lines. In this way we put down several suggestions and finally decide upon the most effective and pleasing one. In making these sketches we must seek for good order, proper balance and simple rhythm in spacing and line. The number of things entering into the book plate gives us at once Variety. Next we block out on the good sheet all that we are going to do, first drawing a vertical middle line upon which we will balance the design. Then the lettering must be very carefully blocked in with faint horizontal lines at the top and bot-

Trying Out Various Ideas



-Final—
Drawing

tom of the words, for guides. Following this we may make a drawing of the book and ink well and last of all the conventional violets which will serve as a border.

When all lines are laid in, we must go over them with great care in ink, after which all pencil lines are cleaned off and any corrections made. The design is now complete.

All designs must be considered just as carefully as we have considered these. The purpose, the material, the construction, the shape, the size; all these questions enter into every design made.

Appreciation of the Work of Artists

When we try to draw or paint we at once begin to appreciate how

beautiful the great drawings and paintings are and how wonderful are the artists who made them. From the experiences of our own attempts we are able to look at the masterpieces from the standpoint of drawing and color and, to some extent, design. For any great picture is orderly and balanced and rhythmic. In studying pictures further, however, the following should be considered:

1. The name nationality and date of the painter.

2. Any features in the picture showing foreign things.

3. What story is told.

4. On what the interest in the picture centers.

5. What time of day or year is suggested.

6. Whether it suggests a similar experience in your own life.

In addition, each picture would present its own questions. Penny pictures may be purchased and a booklet of your favorite pictures will make an excellent design problem, especially if you design a cover in colors.

THE LITTLE NEEDLE-WOMAN

How to Sew, Mend, and Make Different Stitches

ONE of the little girls in the photograph is really sewing on her own new lawn dress, and she is making it all by herself. The dress is partially done and the little girl is anxious to finish it to wear this summer. See how happy she is with her work. Her sister is sewing too, but for the moment, she stops to gaze steadily into your eyes, for she wants to tell you how easy it is to learn to sew, sometimes it's like playing a game.

We will begin the game with the running stitch, because it is so easy, and then "running stitch" sounds as though we too will soon be able to make a dress.

Make a knot in the end of your thread this way. Hold the threaded needle in your right

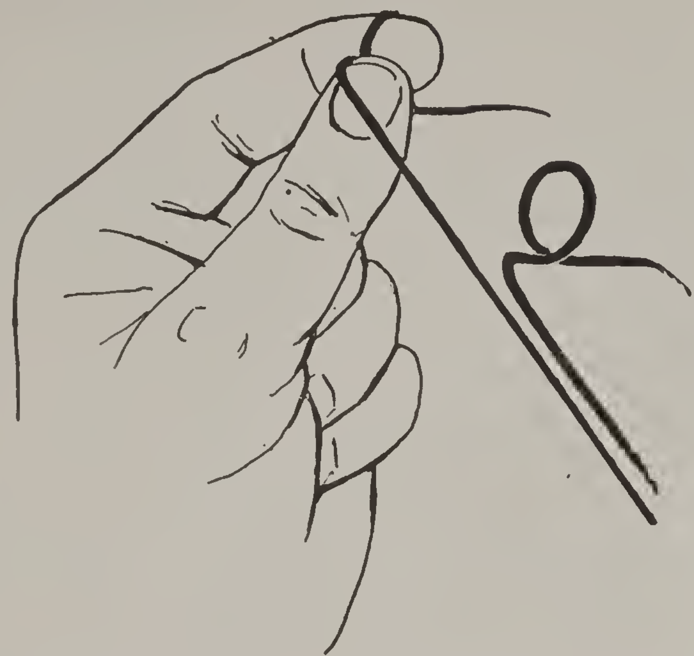


Fig. 1. Making Knot in End of Thread.

hand, with the left take the long end of the thread between thumb and first finger, stretch the thread tight; then wind it once around your first finger, crossing it over that held between finger and thumb Fig. 1. Press the first

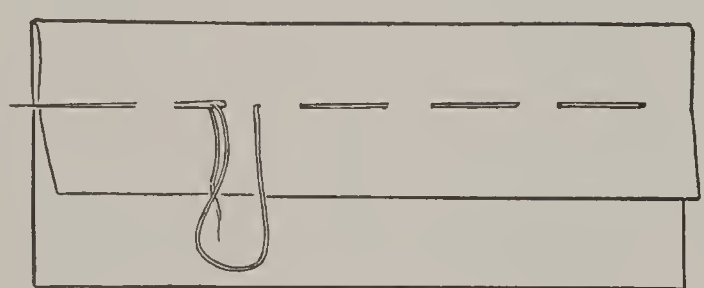


Fig. 3. Basting With Long Stitches.

finger against the thumb as you rub it down carrying the thread along. Push the knot you have rolled to end of the thread; then begin sewing, running your needle in and out of the material, Fig. 2, making stitches the same in size.

Basting is running with long stitches Fig. 3. Fig. 4 gives wrong side.

Gathering is running by taking up two threads and leaving four, Fig. 5. When finished, push the stitches

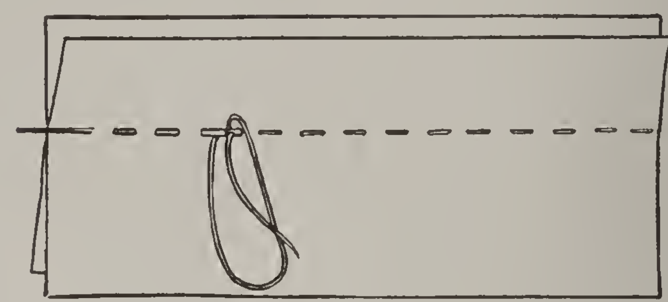


Fig. 2. The Running Stitch.

together and stroke the gathers with coarse needle as in Fig. 6.

In stitching begin by taking a stitch two threads back of needle and two before, then continue in this way making each stitch meet the last as in Fig. 7.

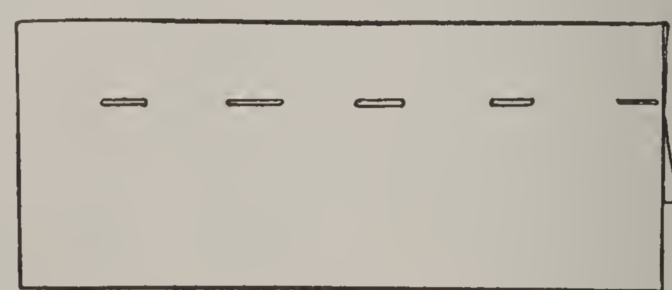


Fig. 4. Wrong Side of Basting.

Backstitching is made two threads back and four forward as in Fig. 8.

In overhanding hold the edges of cloth firmly between thumb and first finger of left hand, and sew across over the top of the edges, keeping the edge next you tighter than the other as in Fig. 9. Open

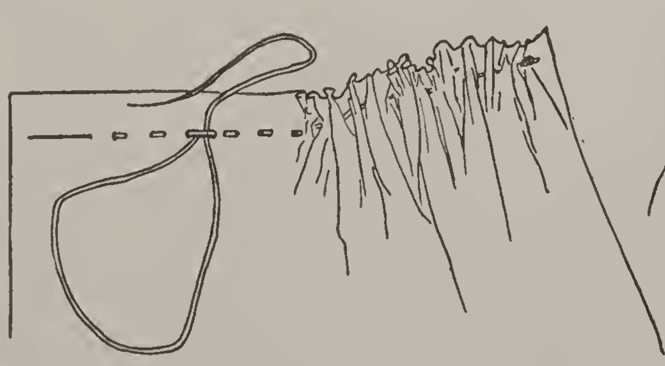


Fig. 5. Gathering.

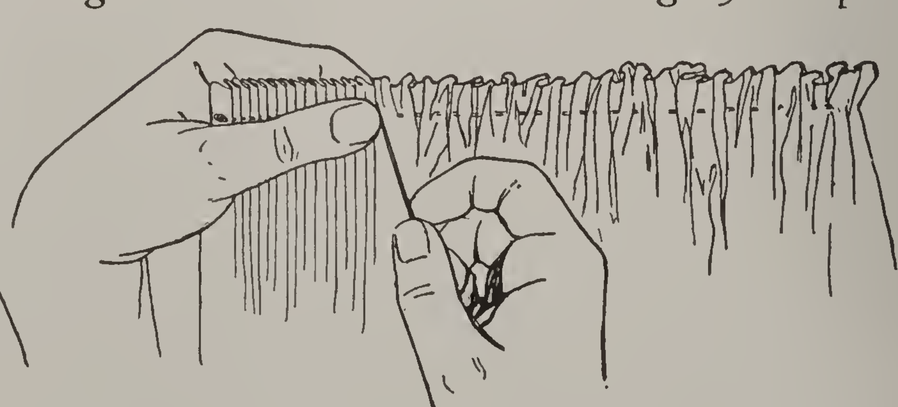


Fig. 6. This Is the Way to Stroke the Gathers.

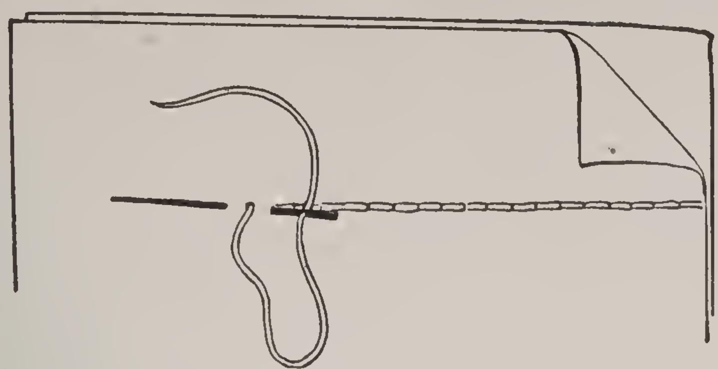


Fig. 7. Stitch This Way.

seam and flatten it on wrong side with thumb nail as in Fig. 10.

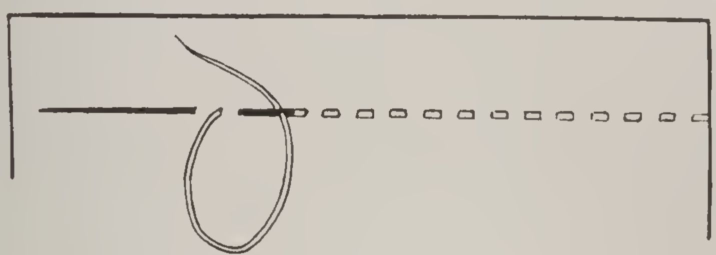


Fig. 8. Back Stitch.

Overcasting is almost the same as overhanding except that the stitches

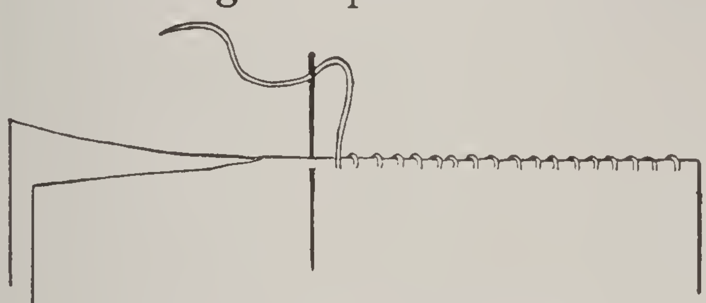


Fig. 9. Overhand Sitch.

slant, are farther apart, are taken deeper and the seam left closed as in Fig. 11.

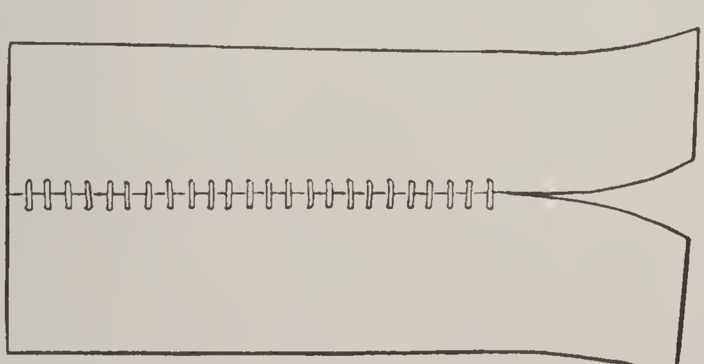


Fig. 10. Flatten Out Overhanding Like This

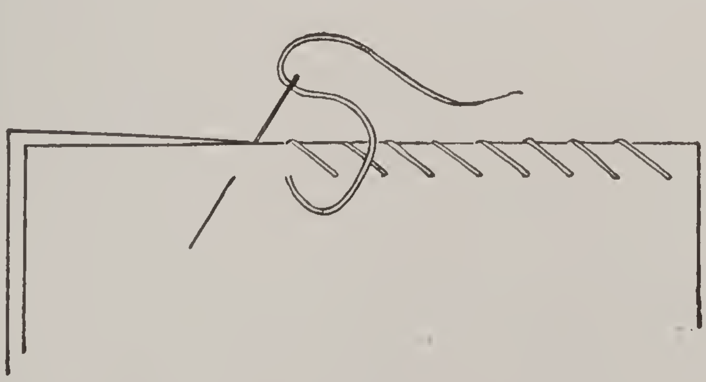


Fig. 11. This is the Way to Overcast.

Hemming. Use a card cut like (A) in Fig. 12, for measuring hem width and keeping it even. Turn in the

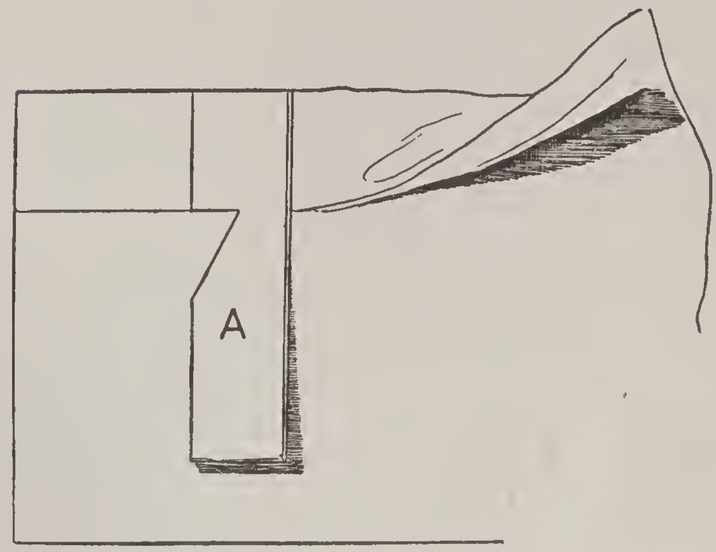


Fig. 12. Measure Your Hem to Keep It Same Width.

raw edge, Fig. 13a, again turn, Fig. 13b. Sew over finger of left

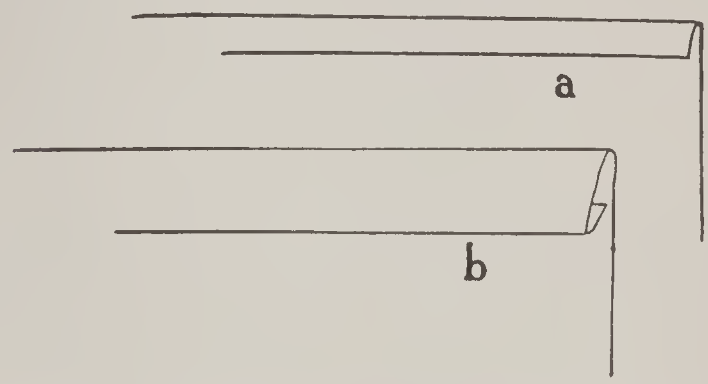


Fig. 13. (a) First Turn-down for Hem. (b) Second Turn-down for Hem.

hand for narrow hem, Fig. 14.

The rolled hem is for sheer material. Begin to roll the edge at right hand corner of goods, holding the edge between thumb and first finger of left hand; then with right thumb and slightly dampened first finger roll the hem, Fig. 15.

In making a French seam baste edges of goods together, and sew with three running stitches and one backstitch. Repeat until the seam is finished as in Fig. 16.

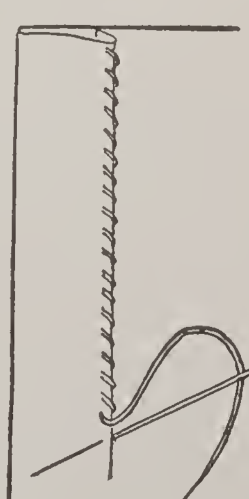


Fig. 14. Common Hemming.

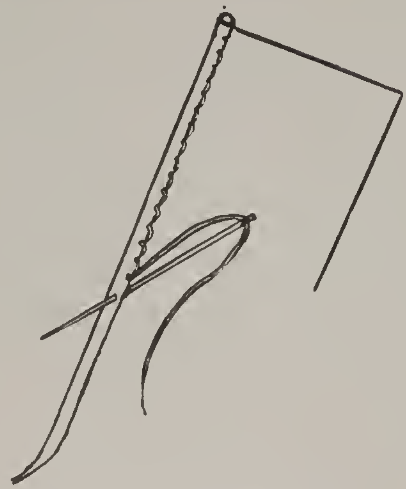


Fig. 15. Rolled Hem.

Open the raw material, turn the sides over the seam, crease close on

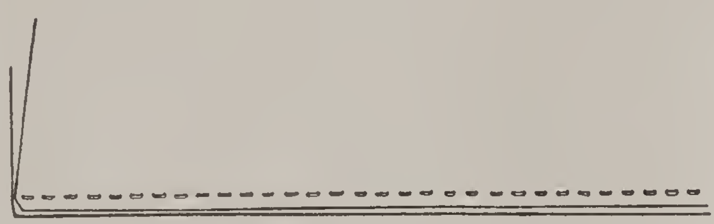


Fig. 16. Edges of French Hem Sewed Together.

both sides of seam, and again sew with first seam inside as in Fig. 17.

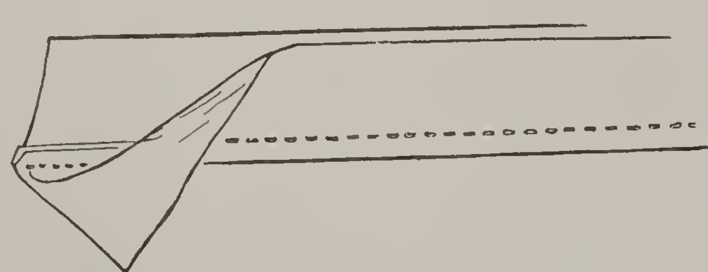


Fig. 17. French Hem, Showing Inside.

In felling baste seam with one edge lower than the other, as in Fig. 18. Back stitch edges together, turn

Fig. 18.

upper edge down over lower, crease it, open the material so the fell lies flat, then crease it down and hem,

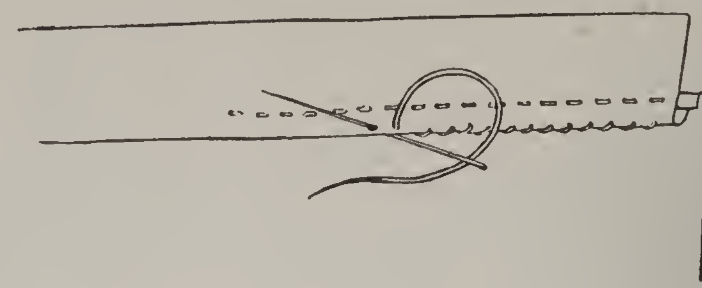


Fig. 19.

using needle when necessary to push edge under fell, as in Fig. 19.

This is the way to make buttonholes. Cut the hole evenly through both layers of cloth and make it fit

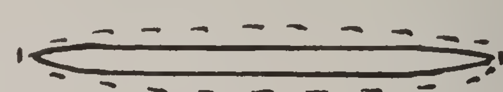


Fig. 20.

your button, overcast the edges or hold them together with a running stitch, Fig. 20. For strength, bar

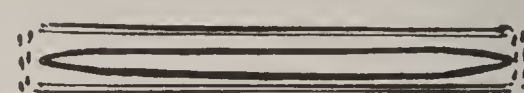


Fig. 21.

corner, also the side, with several threads as in Fig. 21. Make the buttonhole stitches cover the bars of thread.

Begin to work on left corner edge of slit 1-16 in. from edge, and before

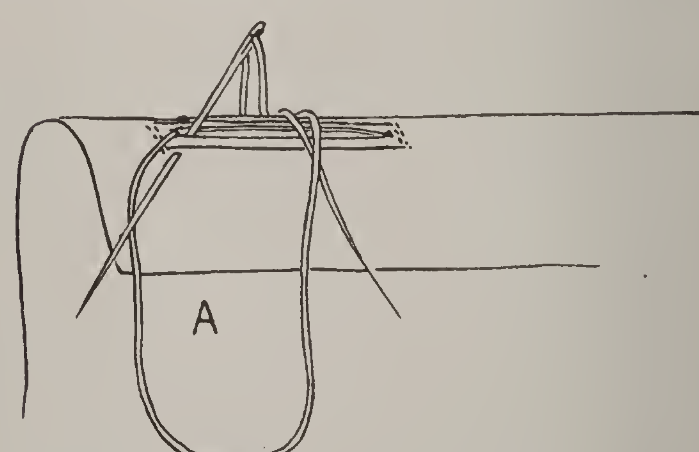


Fig. 22. Buttonhole.

pulling the needle entirely through, carry the thread around to the left and under the needle, then draw the needle through the loop A, Fig. 22. Continue in the same way until the buttonhole is finished as shown in Fig. 23.

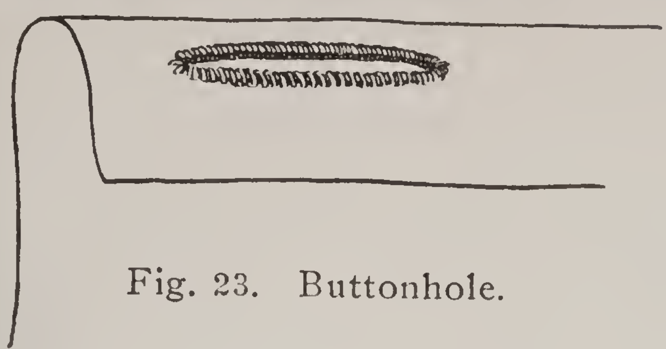


Fig. 23. Buttonhole.

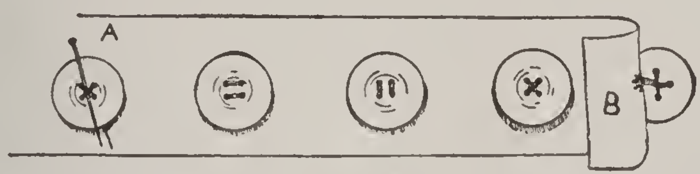


Fig. 26. Correct way to sew on button.

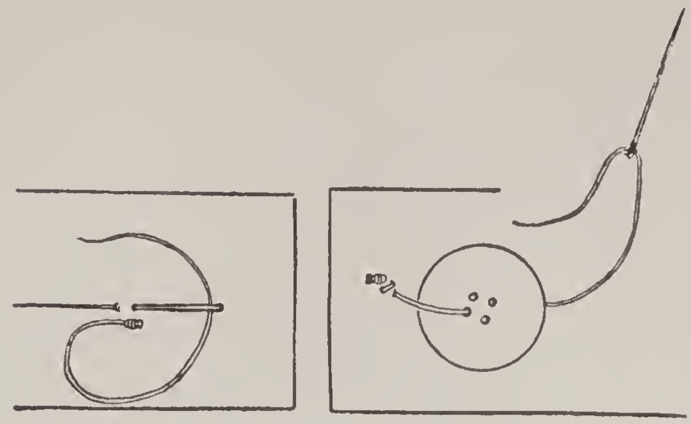


Fig. 24. Take stitch on right side of cloth before sewing on button.
Fig. 25. Then thread on button.

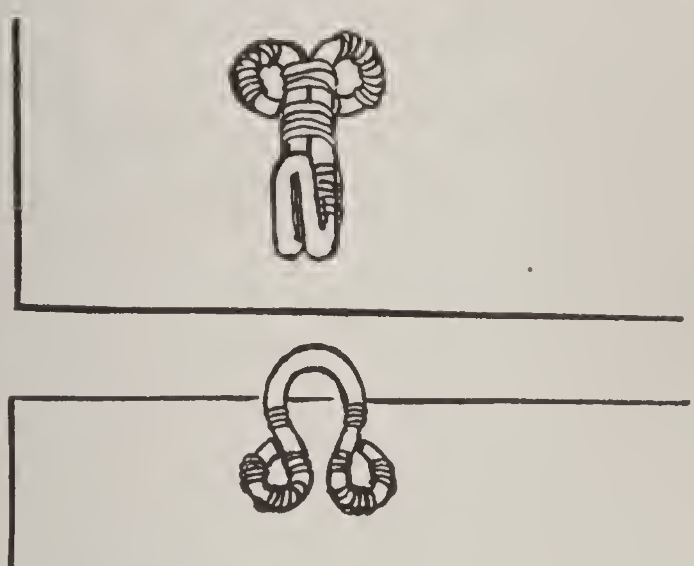


Fig. 27. Sew hooks and eyes on so that they will never drop off.

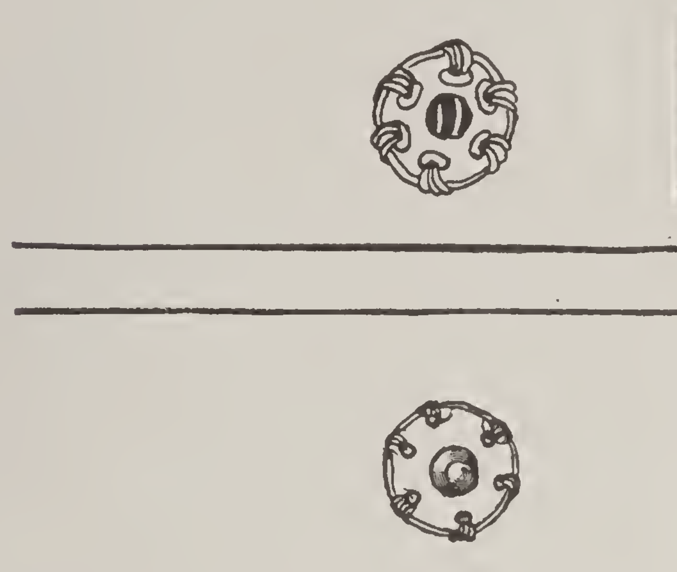


Fig. 28. Dress snaps need careful, firm and strong stitches to hold them tight.

Buttons. Figures 24, 25 and 26, explain sewing on buttons correctly.

First take a stitch on the right side of cloth where you want your button, Fig. 24; then thread your button, Fig. 25. Sew over a pin, Fig. 26, A, to make stitches loose for winding with thread between button and cloth, Fig. 26, B.

Fig. 27 explains how to sew hooks and eyes.

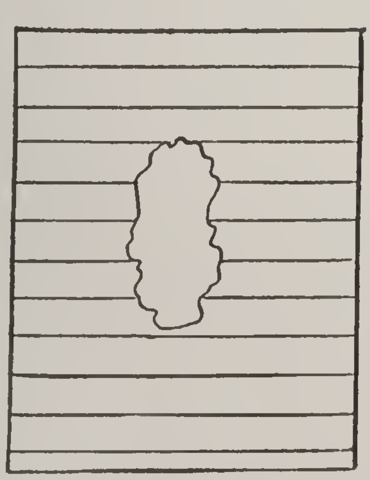


Fig. 29

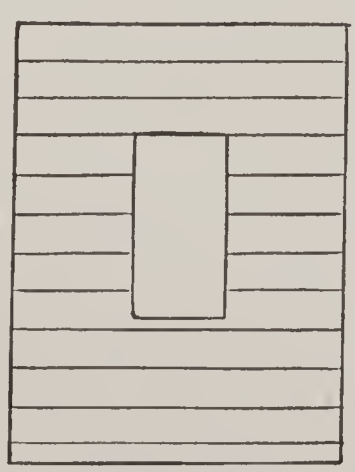


Fig. 30

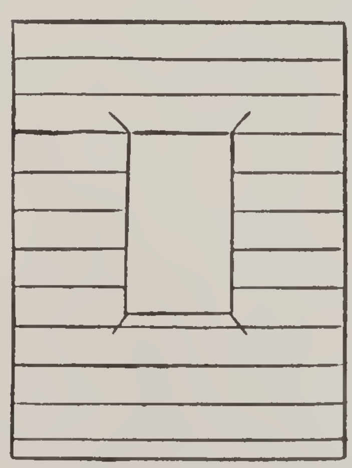


Fig. 31

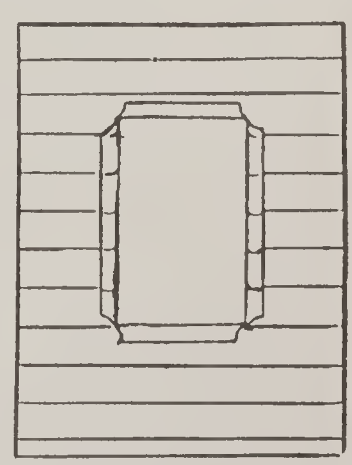


Fig. 32

Dress Snap Fasteners must be sewed on strong and tight, as shown in Fig. 28.

Mending. When material is figured or striped, cut patch to match design. Fig. 29 shows a hole in striped cloth, Fig. 30, the ragged edges cut straight. Fig. 31 shows the ¼ inch bias cut in corners. Fig. 32 tells how to turn down these flaps; then the patch can be placed over

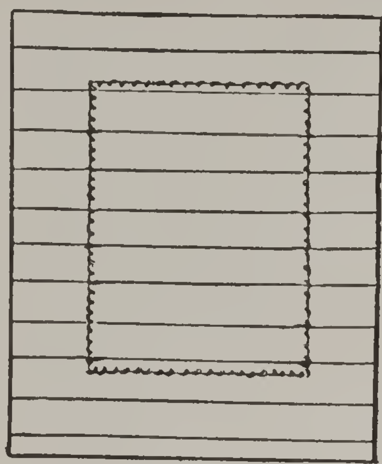


Fig. 33.

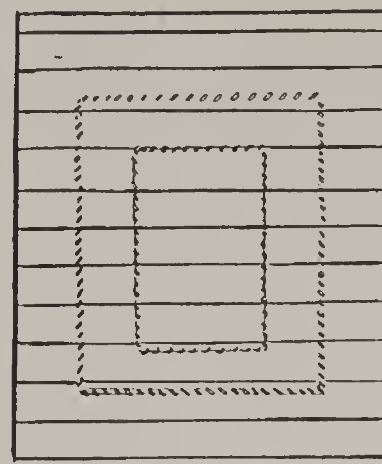


Fig. 34.

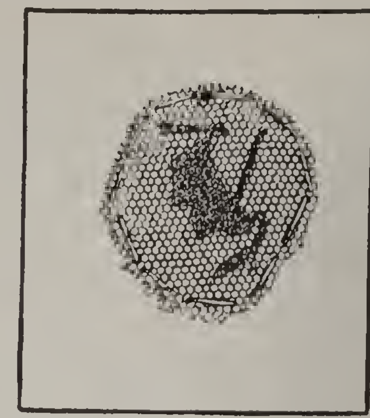


Fig. 35. Darn strengthened and reinforced with net.

flaps and hemmed to goods, Fig. 33. Fig. 34 gives right side of material with the turned in edges of hole hemmed on patch.

Mending With Net

Worn places in embroidery, lace, etc., need net to strengthen the darn.

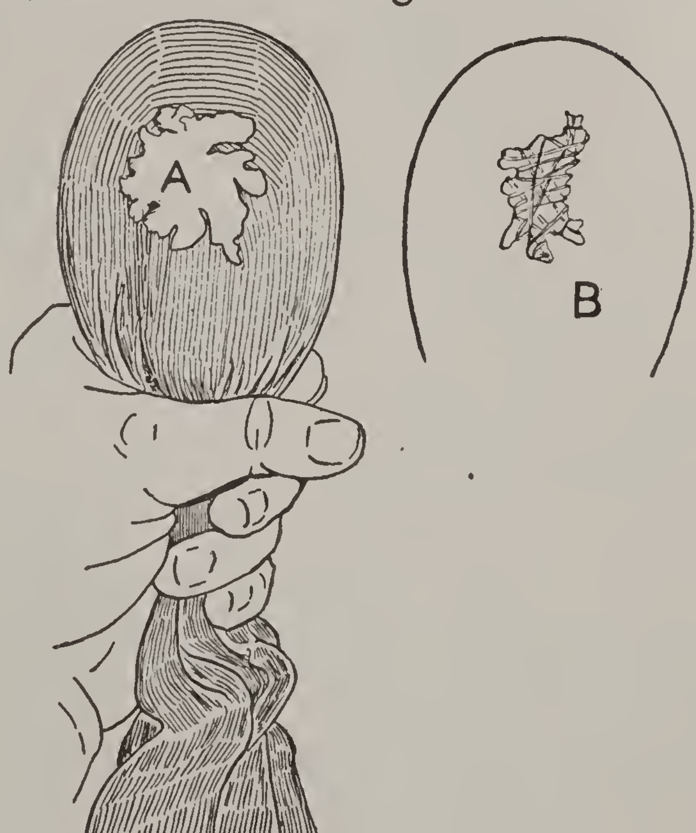


Fig. 36. Stocking ready for mending.

Baste the net on the wrong side of goods over spot to be mended; darn through both material and net. Then whip edges of net to goods. Fig. 35 gives wrong side before edges are whipped.

In darning a stocking slip the stocking over an egg, Fig. 36 A, then with needle and thread, draw edges of hole closer together, Fig. 36 B. Begin darning ½ in. from the hole, using cotton of same color as stocking. Work with running stitch, straight across and ½ in. on the other side of hole; leave a loop of the cotton at the end of each line, Fig. 37. Darn across the first threads and when reaching the hole,

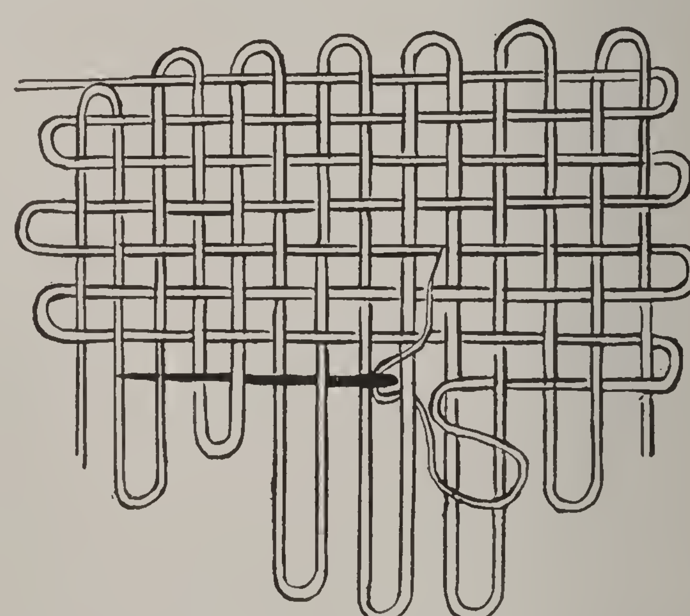


Fig. 37. This is the way to weave when darning.

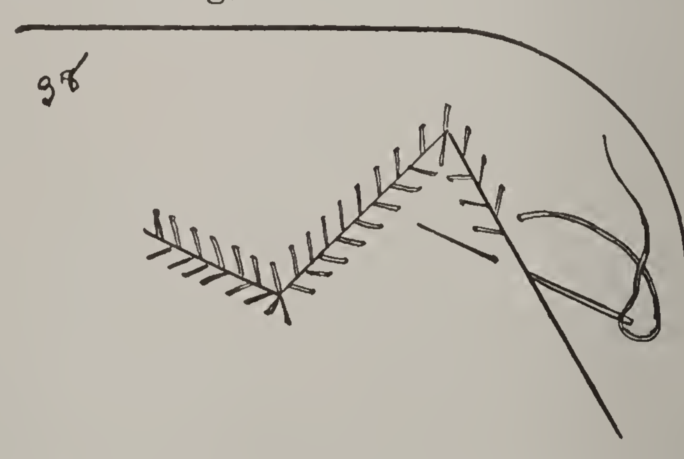


Fig. 38. Basting tear edges together ready for darning.

weave the cotton over and under. Fig. 37 is wide spaced to show how to weave.

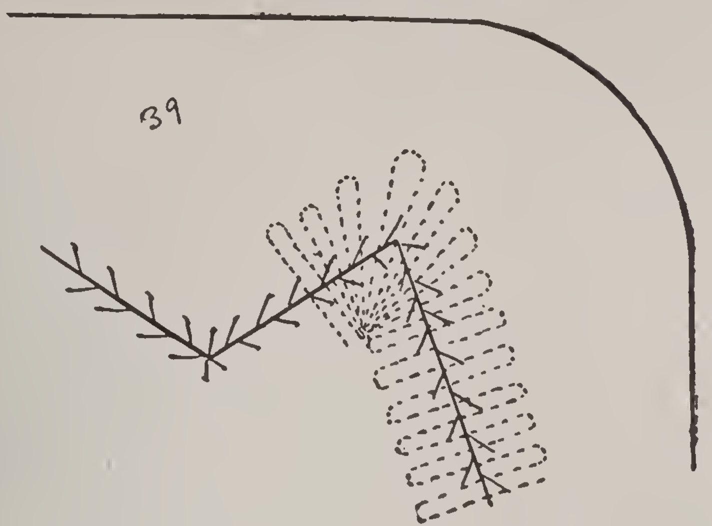


Fig. 39. Darning tear with running stitch.

In darning a tear draw the edges smoothly together by taking one basting stitch on one side of the tear, then one on the other, passing the needle through the open slit of tear for each stitch, Fig. 38.

Then darn with running stitch, leaving loop at each turn, Fig. 39, and carefully remove basting.

Fig. 40. Glove mended with rows of buttonhole stitches.

For a rent in a glove, buttonhole around edge of opening, and continue making rows until the opening is filled, as in Fig. 40.

Big and Little Things

I cannot do the big things
That I should like to do,
To make the earth forever fair,
The sky forever blue.

But I can do the small things
That help to make it sweet;
Tho' clouds arise and fill the skies
And tempests beat.

I cannot stay the raindrops
That tumble from the skies;
But I can wipe the tears away
From baby's pretty eyes.

I cannot stay the storm clouds,
Or drive them from their place;
But I can clear the clouds away
From brother's troubled face.

I cannot make the corn grow,
Or work upon the land;
But I can put new strength and will
In father's busy hand.

I cannot stay the east wind,
Or thaw its icy smart;
But I can keep a corner warm
In mother's loving heart.

ALFRED H. MILES

Making New Clothes for Mary Chilton

Here you see Mary in a "dress-up" dress and also in her new middy blouse and bloomers.

I'LL tell you what let's do. Suppose we make clothes for our doll, Mary Chilton. She is a regular outdoor girl and needs something suitable for playing tennis, camping and for trailing.

Bring your khaki-colored cambric and we'll cut a middy blouse by the pattern. Hold the material lengthwise and pin on the pattern, Fig. 1. Now cut it out and baste together the seams of sleeves AA and AA, and of sides AB and AB, as in Fig. 1. Fig. 2 shows the garment basted ready for sewing together with French seams. This done, hem edge of sleeves, and bottom of blouse; then cut out the sailor collar, Fig. 3, hem the outer edges, and baste the collar on neck opening of blouse. Cut

Silk Work Bag

How the Middy is Made

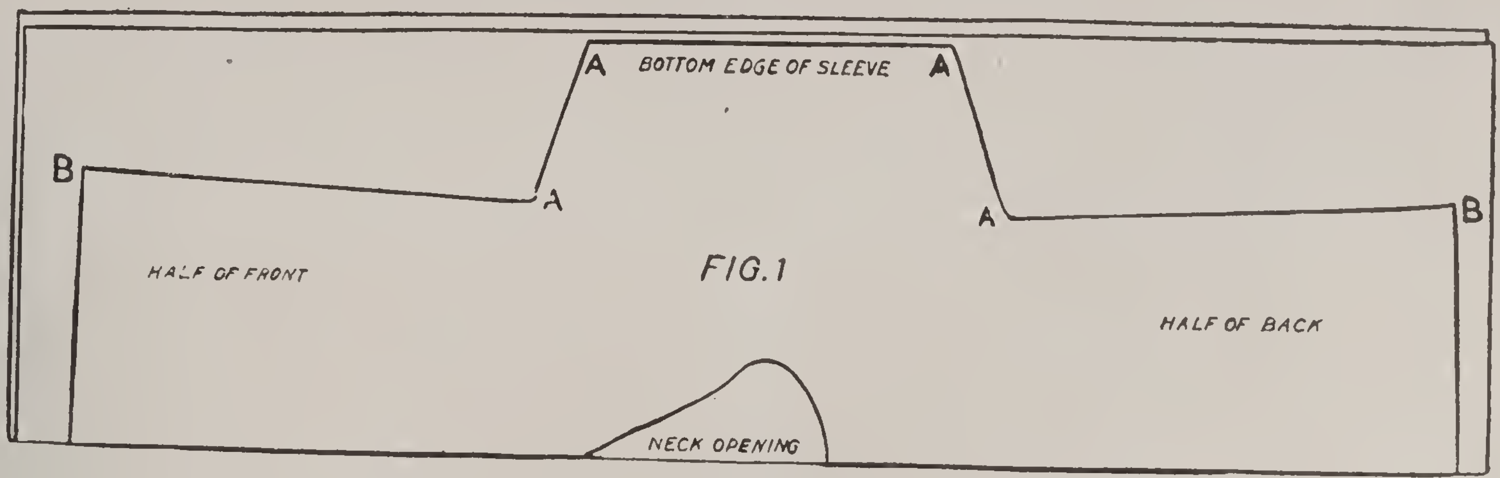


FIG. 1

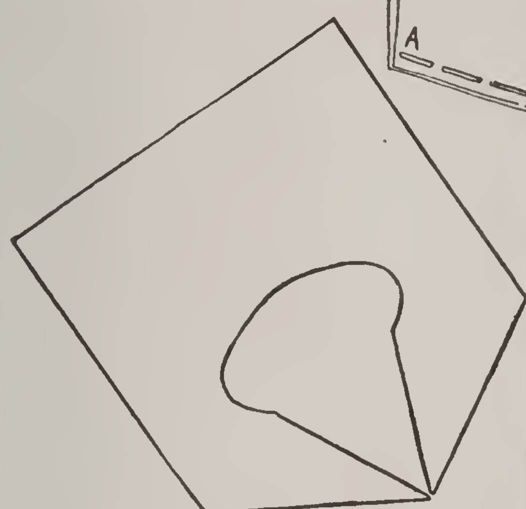


FIG. 3

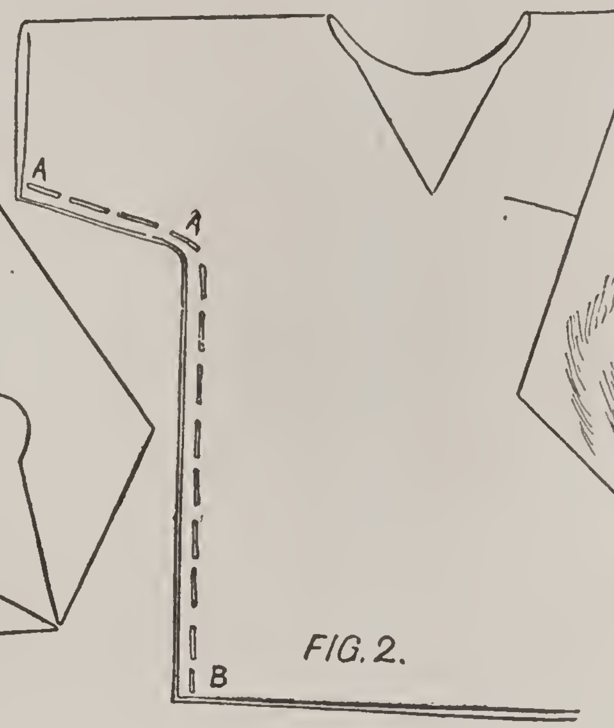


FIG. 2.


FIG. 4

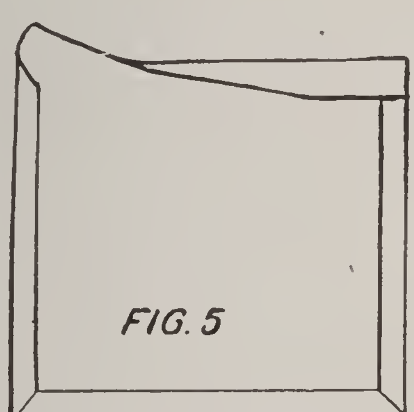


FIG. 5

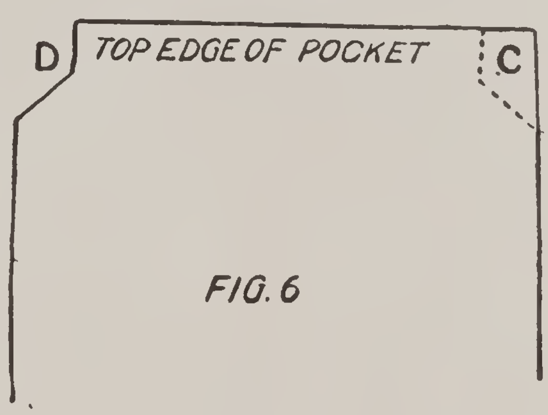


FIG. 6

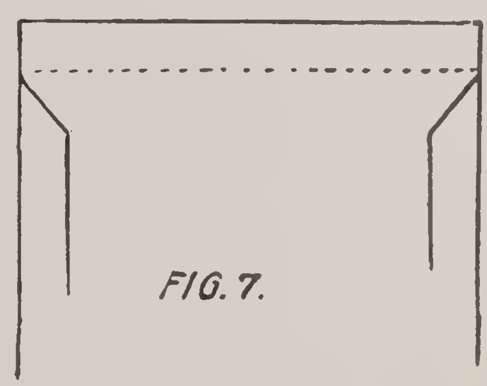


FIG. 7.

a bias strip of the goods and baste the strip on along the raw edge of the collar Fig. 4. Sew all three edges together, joining strip, collar, and blouse; then turn the strip over the raw edges, fold in its raw edge, and hem the strip down on the middy.

A square of the same goods can be used as a patch pocket. Turn in a hem on the bottom and sides, Fig. 5, and cut the top corners according to dotted line C, Fig. 6, which makes the corners like D, Fig. 6. Turn down top hem along dotted line Fig. 7, and sew. Try the blouse on Mary Chilton, pin the pocket in place and stitch it on the blouse.

Fig. 8 gives the pattern for one half of the bloomers; double your material, pin on the pattern and cut out the bloomers. Sew together the two short edges EE then the two long ones FF. Face each side placket with strip of goods, Fig. 11.

Picture Story of the Bloomers

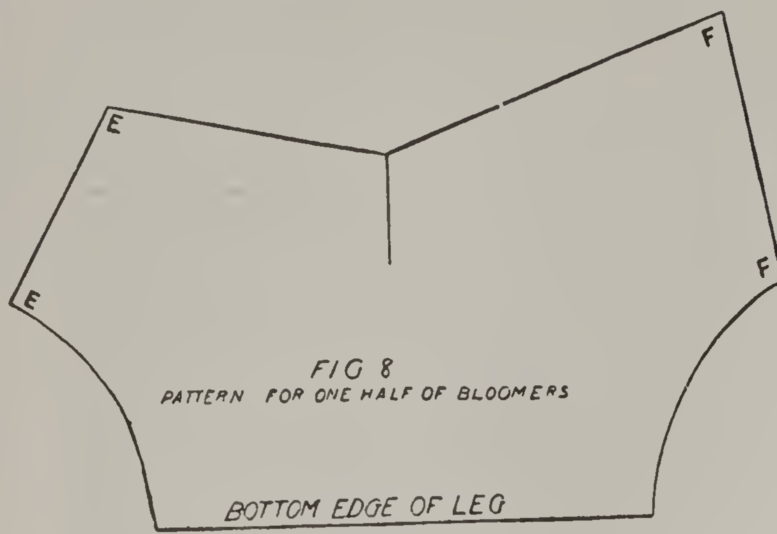


FIG 8
PATTERN FOR ONE HALF OF BLOOMERS

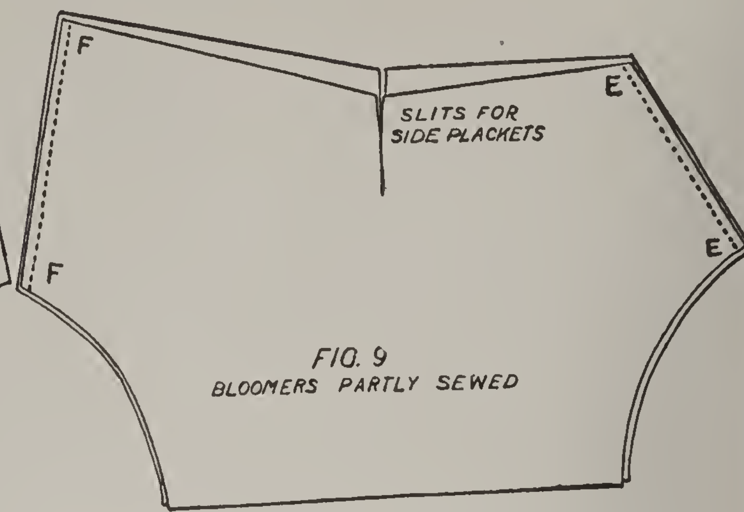


FIG. 9
BLOOMERS PARTLY SEWED

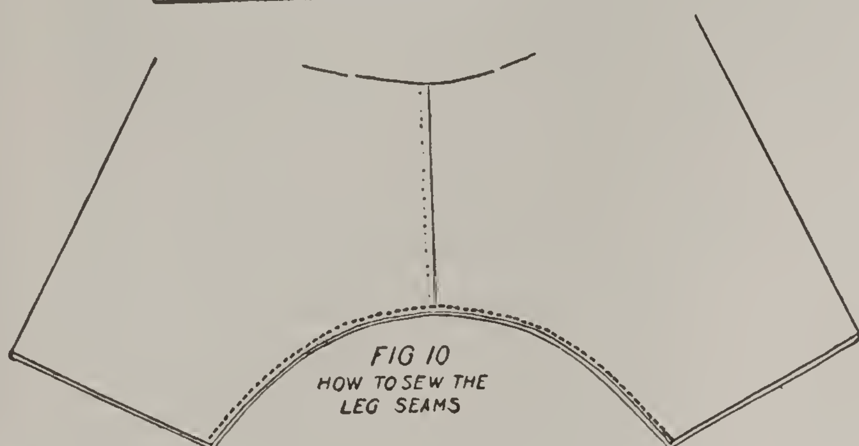


FIG 10
HOW TO SEW THE LEG SEAMS

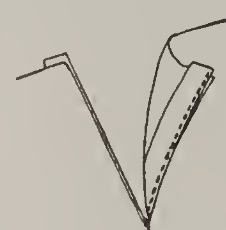


FIG. 11

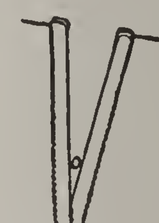


FIG. 12

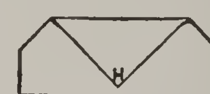


FIG. 17

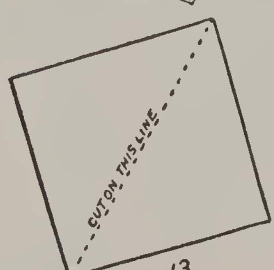


FIG. 13


FIG 14

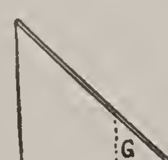


FIG. 15

FIG. 16


FIG. 18

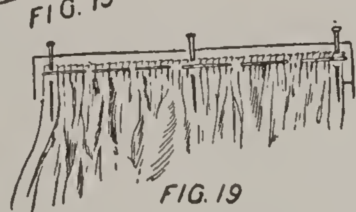


FIG. 19


FIG. 20

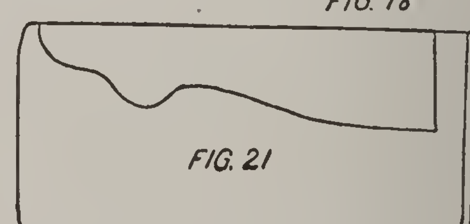


FIG. 21

Sew strip on right side then hem down, Fig. 12. For gussets cut a square into two triangles, Fig. 14, then, Fig. 15, cut off the two corners G. This gives you Fig. 16. Fold on dotted line and gusset is ready to use, Fig. 17. Fit point H of the gusset, Fig. 17 in the opening (O) of the placket, Fig. 12. Sew the point in on right side with over-and-over stitch. Dotted line, Fig. 18, shows the right side of gusset. The remaining part is folded over on the wrong side and hemmed down, Fig. 18. Gather the top of the bloomers, stroke gathers and pin the center of each to the center of a band; also pin each gathered end to the band, Fig. 19. Baste the band in place and stitch the bloomers to the band; then fold the band over, turn in and overhand the ends, and hem the band down on wrong side of bloomers, Fig. 20. Run elastic in the bottom hem of each leg of the bloomers and fasten the plackets with buttons and buttonholes.

For stockings, hunt up an old discarded long silk or cotton glove, pin

For Making Mary's Hat

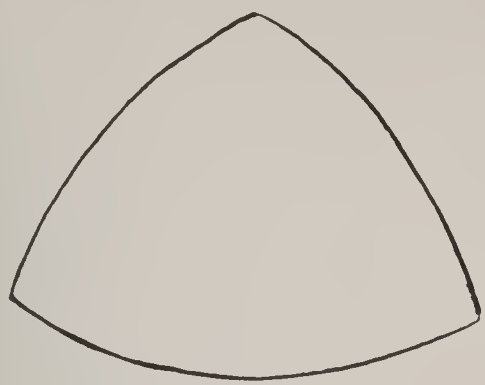


FIG. 22

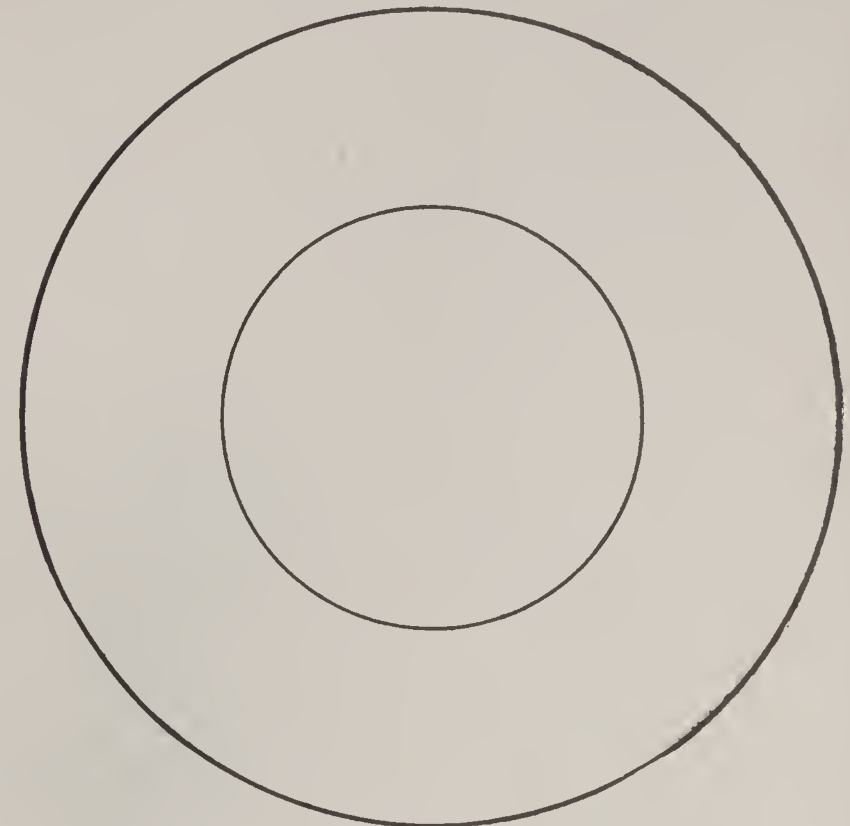


FIG. 23

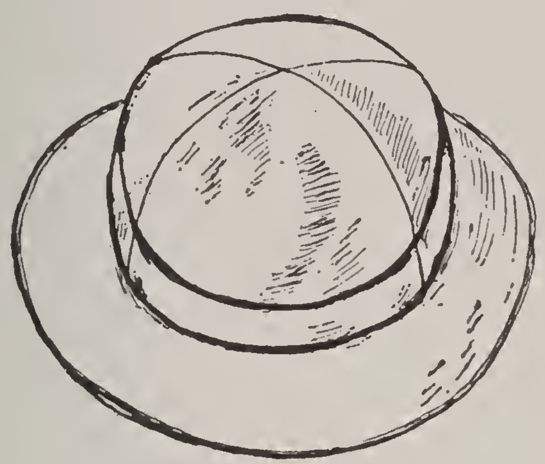


FIG. 24

on the stocking pattern, Fig. 21, and make Mary Chilton a pair of stockings. Hem the tops and stitch the seams.

Now Mary needs a khaki cambric hat for her khaki suit, so make the crown of four pieces of the material cut from Fig. 22; sew the side edges together and fit the crown on Mary; make smaller if too large. Cut the brim, Fig. 23, double, making two circles, sew the outside (circumference), edges together and turn the brim right side out, causing the raw edges to lie between the two layers. Stitch one small, loose, circular edge to the edge of the crown and hem the other loose edge over the seam down to the crown, Fig. 24. The photograph shows Mary Chilton proudly wearing her complete khaki outdoor suit.

Mary's union underwear can be of soft cambric. Fold the goods and place the pattern with its straightest, longest edge on the fold as in Fig. 25. This entire garment is in one piece of cloth, and opens at the back. Fig. 26 gives the cut-out garment folded before being sewed. The dotted lines show the edges of the drawers hidden under the waist and one drawer leg. Fell the two edges, PP and PP together, Figs. 25 and 26; then fell the leg edge, PM to NI, Fig. 25. Fell together the arm and waist seam LJ and LJ, Figs. 25 and 26. Face and gusset the plackets, RQ, Fig. 25. Hem the bottom of the legs; also opening sides of waist and bottom edge. Use a bias strip of the goods for facing the edge of neck. Gather the loose top edge of drawers and sew on a band; fasten to waist with buttons and buttonholes; fasten back of waist in same manner. Trim with whipped on over-and-over stitch, ruffles of lace, Fig. 27 and Fig. 28.

Make a white petticoat of a strip of cambric; sew seam at back with running stitch, leaving part way open

Lingerie for Little Mary

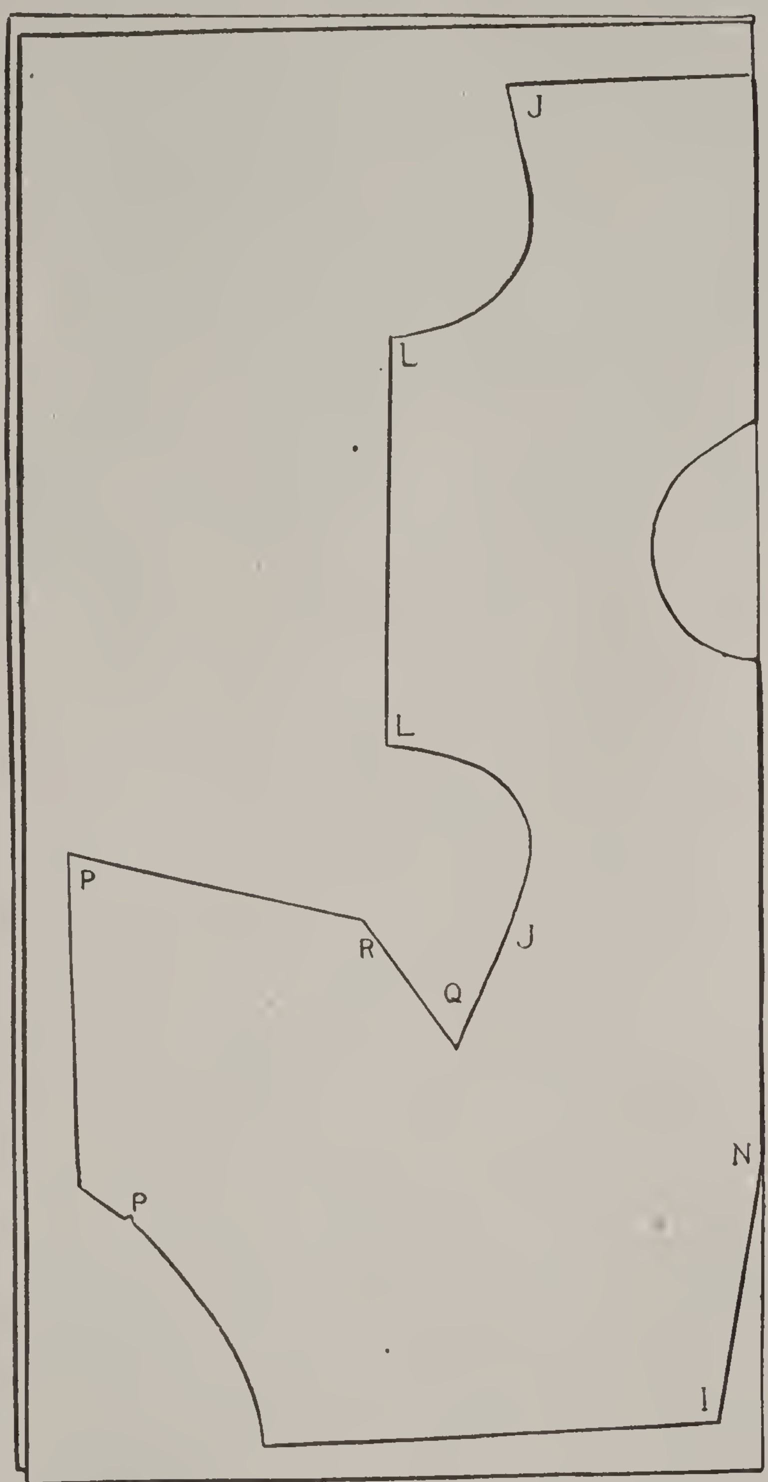


FIG. 25

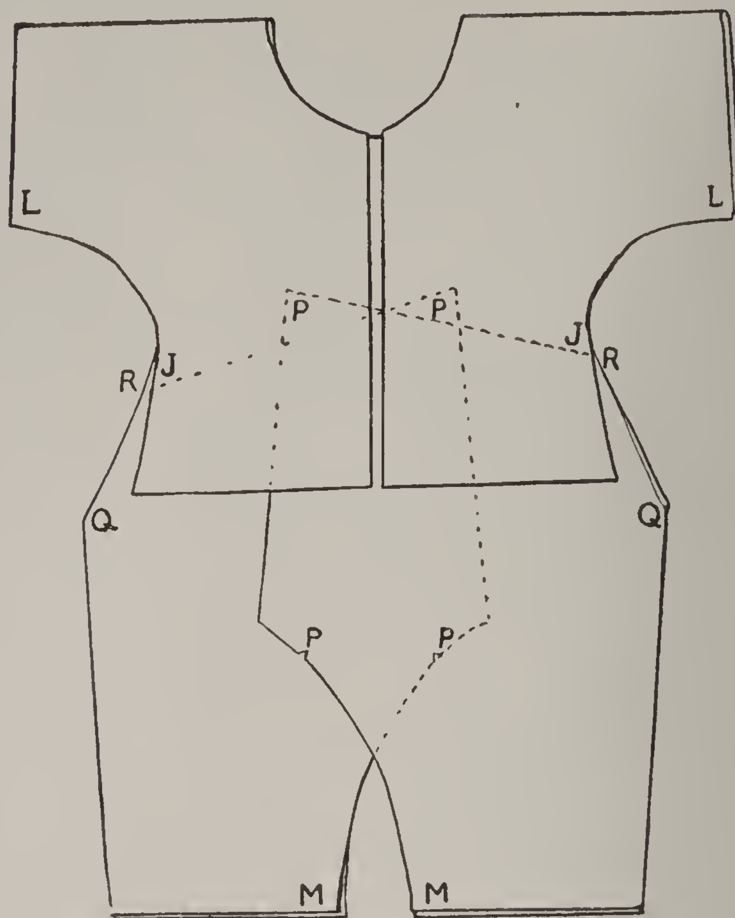


FIG. 26

at top for placket; hem bottom; gather top and sew on band; fasten with button and buttonhole.

If you have some lace, make a dainty party dress for Mary Chilton's birthday. Cut the waist by the middy blouse pattern, changed only by opening all the way down the back and rounding the neck. Let the waist be of white net; hem the bottom edge and whip on a deep lace ruffle for the skirt part of dress. Trim neck and sleeves with lace edging; fasten the back with lace buttons and loops after first hemming the raw edges.

Have Mary Chilton wear a broad ribbon belt or sash, and in her hair an upright ribbon bow, as in her photograph.

Mary has been longing for pajamas like the other girls wear, and they are easy to make. Fig. 29 is the pattern. Fig. 30 gives one cut-out cambric leg. Make two of these and fell all seams; hem bottom of legs and face the edge at waist line; through the tube thus made run a tape drawstring. Cut and work two button holes in pajamas near the front of waist line, and allow the ends of the tape to come out of these openings, to be tied together when the garment is worn.

Cut the pajama jacket from Fig. 31; fell seams; hem edge of sleeves, and bottom of jacket; face neck and front opening. Fasten with small

This is the Finished Garment

FIG. 27

With Three Little Buttons at the Back

FIG. 28

This is How it Looks in Front

For Mary's Pajamas

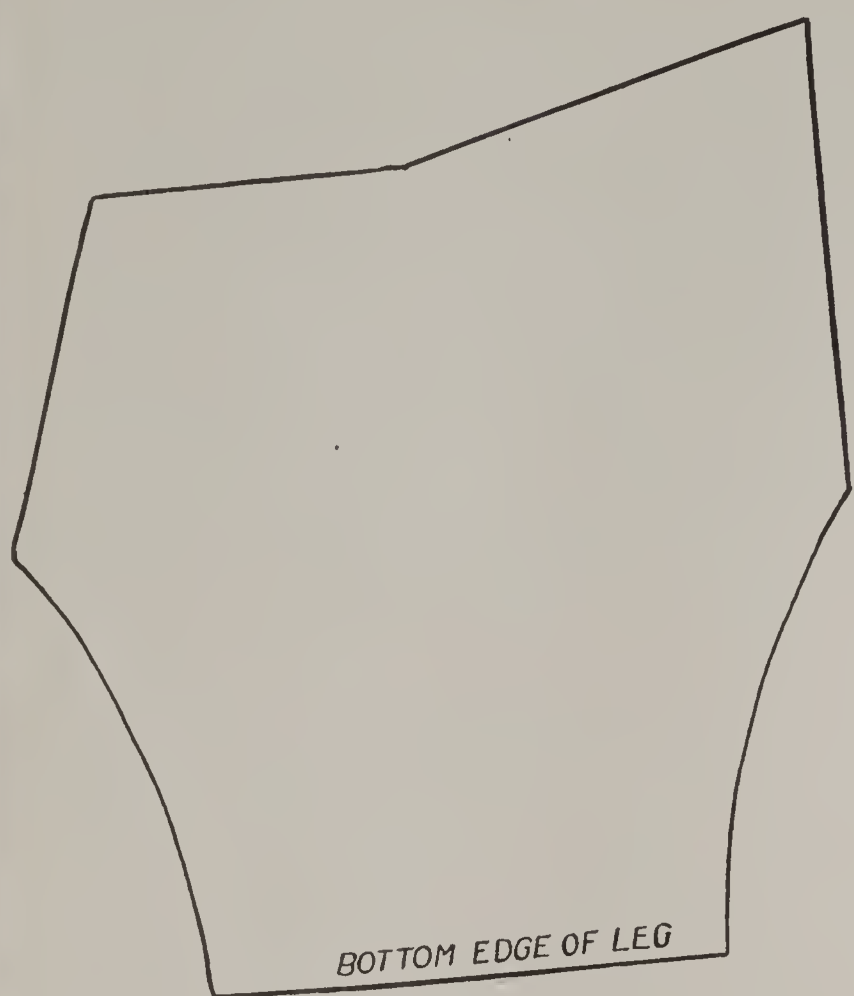


FIG. 29

FIG. 30

dress snaps and sew ornaments of soft white string down the front, Figs. 32, 33, 34, 35.

With the pajamas go white bedroom slippers. Cut the slippers of cambric, Fig. 37, and sole of heavy white paper, Fig. 38. Make a very narrow hem entirely around, Fig. 37, then paste on the sole, Fig. 39. Gather the front edge of the slipper up right and it forms the top; ornament with a double knot of the soft string like those on the slippers Mary Chilton wears in her nighty picture. Cut out a paper candle in candlestick and fasten it in Mary's hand.

Christmas is coming and I will help you make a handsome bureau scarf present.

First hemstitch both ends of the scarf; then, allowing generous space for the applique, which simply means to cut a design out of one piece of cloth and hem it down on another, draw out the crosswise threads as for a deep hemstitch, and with coarse thread and needle bind the remaining threads with the sheaf stitch, Fig. 42. Sheaf stitch means bunching threads of the goods and tying them together with your needle and thread, T and T, Fig. 42.

After drawing out the threads strengthen the two cut edges by working across them with narrow buttonholed stitches. Use oval embroidery hoops for holding the drawn work smooth and firm while doing the sheaf stitch. Begin by fastening your thread in one of the buttonholed sides, Fig. 42S, and work from left to right. Run the needle under about six threads, Fig. 42V, bringing it out at open space X, Fig. 42. This forms a loop; pass your needle through the loop, Fig. 43Y, draw the thread tight and the

Pajama Jacket and Slippers

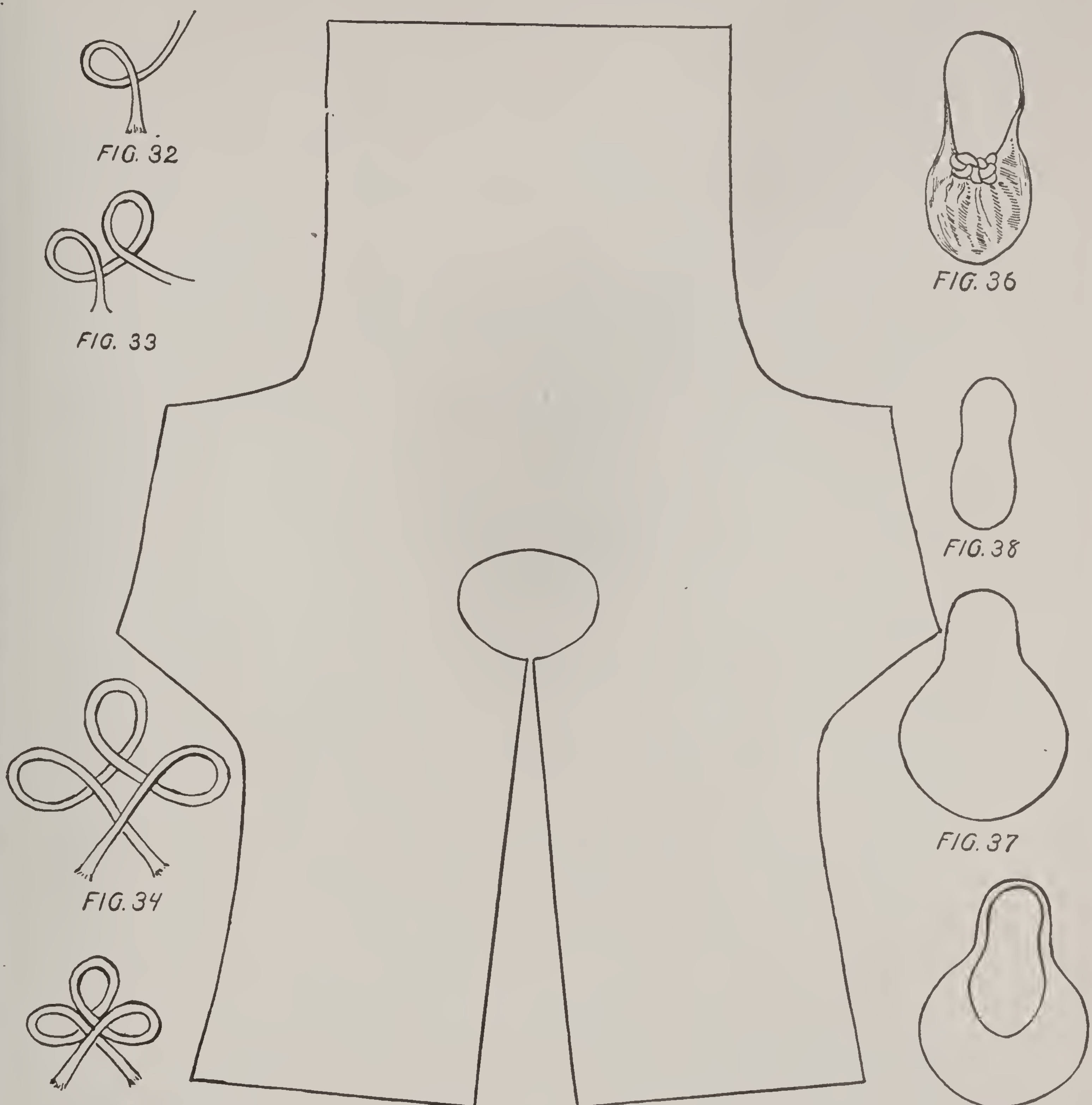


FIG. 32

FIG. 33

FIG. 34

FIG. 35

FIG. 31

FIG. 36

FIG. 38

FIG. 37

FIG. 39

sheaf stitch will be finished.

Choose a pretty embroidery design, white or fast colors, or cut out fast color cretonne flowers; turn under and baste down all raw edges; then baste the design on the scarf and with fine needle and thread hem it on the scarf, Fig. 40.

The practical little handkerchief case is another gift you can make, Fig. 47. Cut four pieces of cardboard 3½ in. square, place one cardboard between two thin squares of raw cotton and lay these on a 4 in. square of flowered silk, Fig. 44. Turn the two sides WW, Fig. 44, over on the lining and catch the material from side to side with long stitches, Fig. 45. Catch the two opposite sides together in the same manner, Fig. 46.

Cover the second square of card-

Pretty Work with the Needle

board as you did the first, and with fine needle and thread overhand the two silk-covered squares together; this finishes the bottom of the handkerchief case.

Make another silk-covered square like the bottom, feather-stitch it around the edge with heavy twist, and use it for the top, place folded handkerchiefs between top and bottom and hold all together with a silk elastic band, ornamented where the ends join by a generous bow of narrow ribbon.

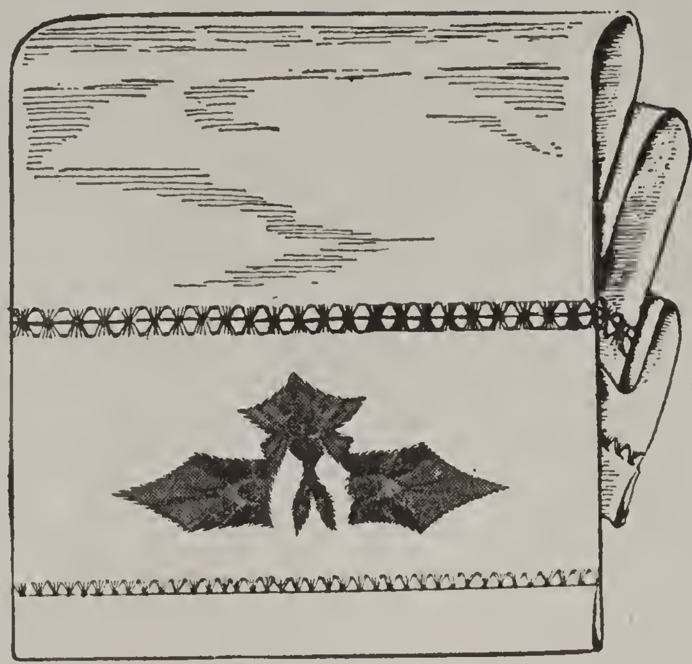


FIG. 40

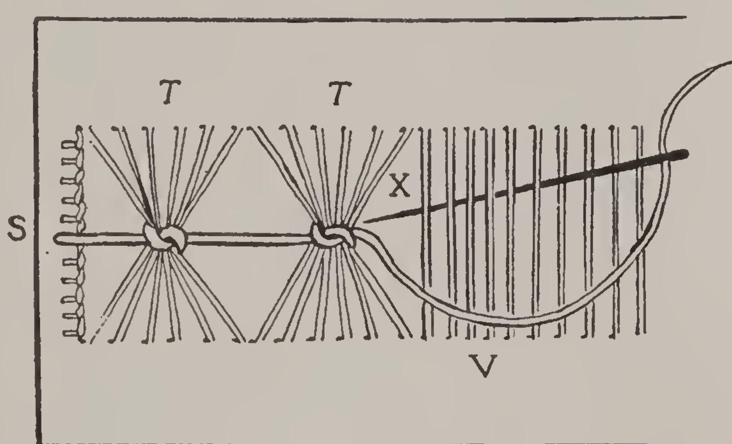


FIG. 42

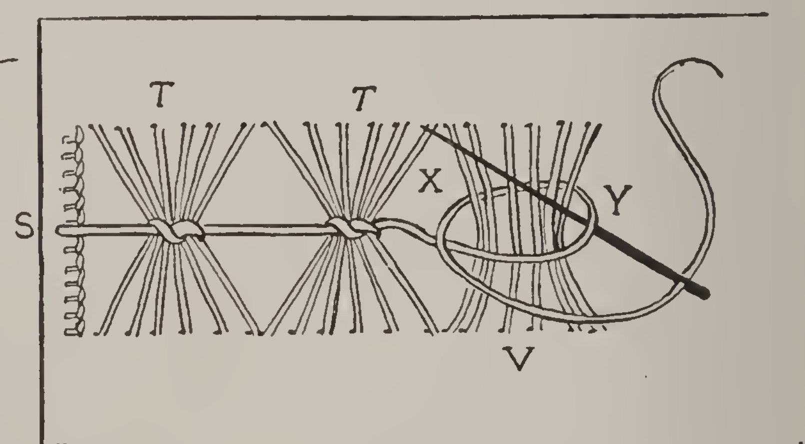


FIG. 43

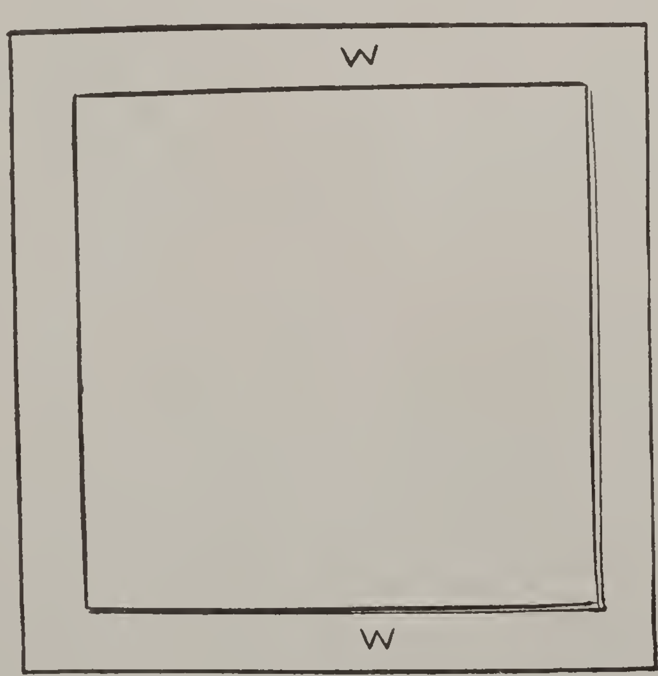


FIG. 44

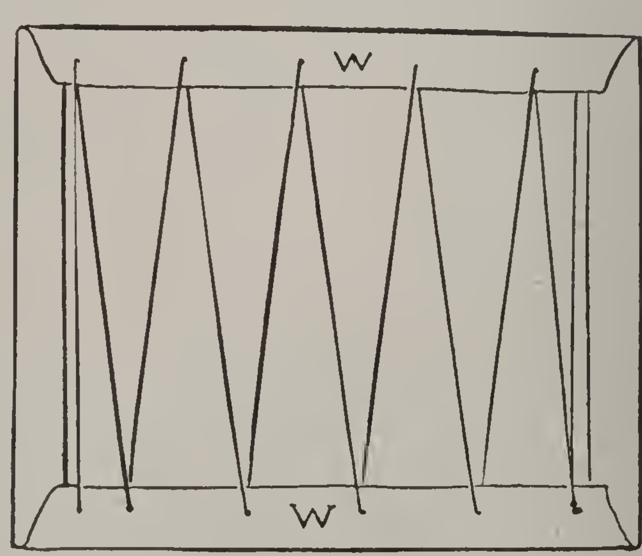


FIG. 45

A Handkerchief Case That You Can Make for Yourself

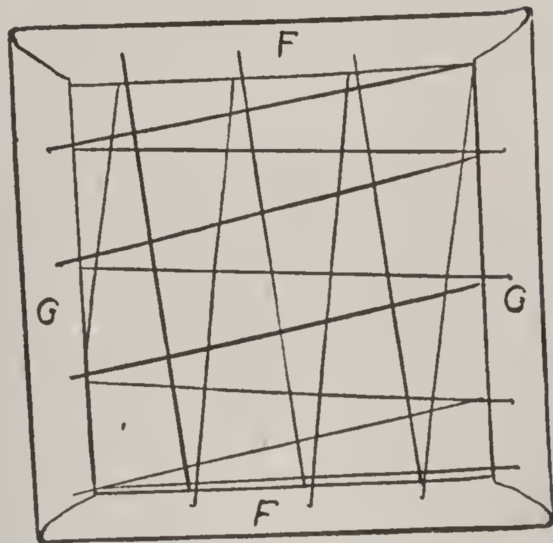


FIG. 46.

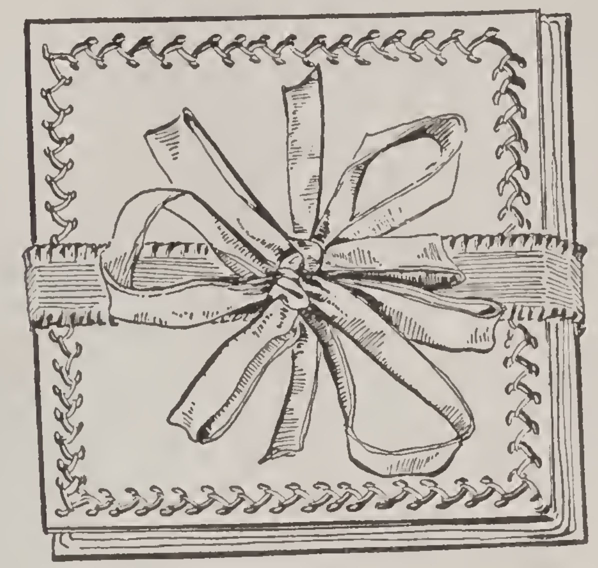


FIG. 47

Dolls from Many Lands

We can play this is Mary enjoying a visit with a number of friends "from abroad." One of the little lady visitors is from Sweden, three from Germany, one from Austria, one from Wales and one from Scotland. On Mary's right is a Swedish lady, on her left, a German. The one back of the big wooden shoes is from Austria. (The shoes belong to somebody else!) Near Mary's right foot is another queer little lady with a hat somewhat like that of the Austrian. She is from Wales. Near her is another German doll. The one sitting at the extreme left of the picture—how well she sits alone—is a Scotch lassie.

Things to Weave

The Basket Weaver

OF course you can make a basket, and enjoy the weaving as much as the two little girls in the picture are enjoying it. Just try, and find how really easy it is. When the basket is finished you will have made something substantial, useful, and pretty, and you may then be justly proud, for you will have woven it with your own hands.

Basket reeds are graded and numbered according to size, the lower the number the more slender the reed, and as the number goes higher the reed is heavier and larger in circumference. Reeds used for spokes of a basket should always be stronger and heavier than the weaving reeds. If you want a good sized basket use long, heavy reeds as spokes, for a small basket select short reeds of lighter weight.

To make a basket like that being woven in the picture,

How a Basket Grows

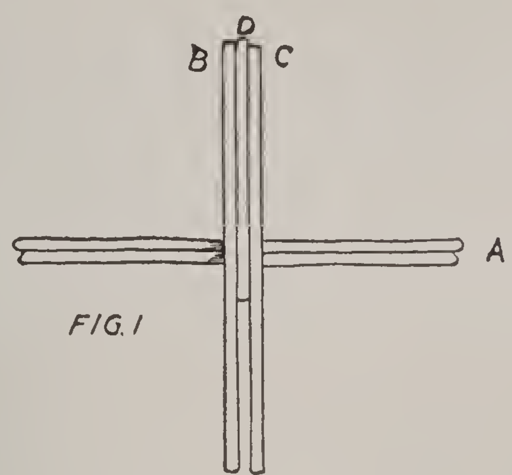


FIG. 1

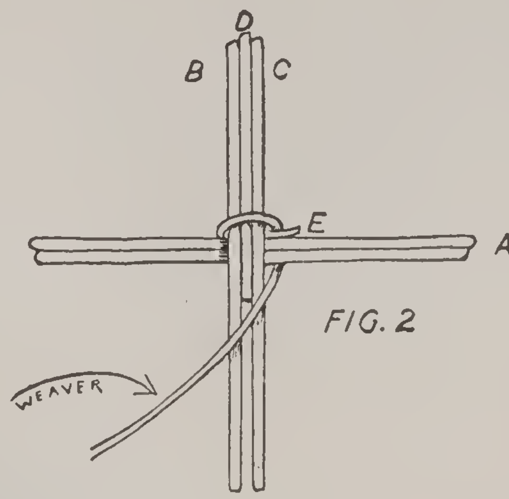


FIG. 2

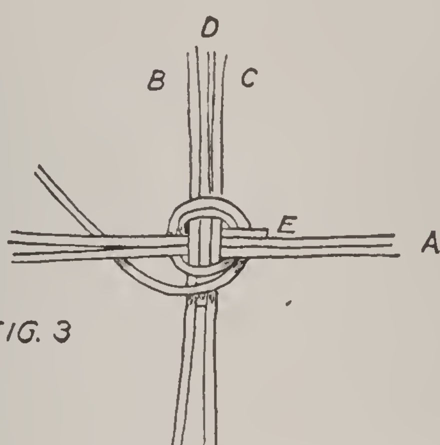


FIG. 3

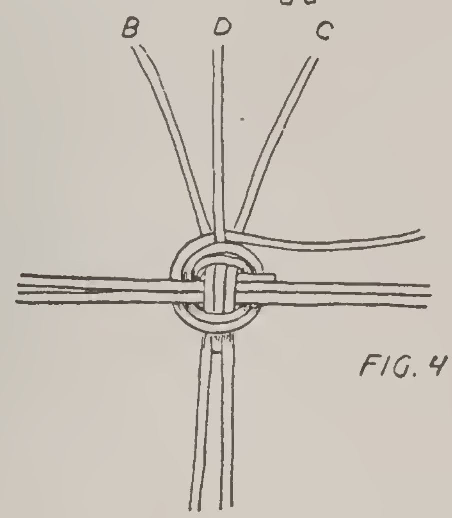


FIG. 4

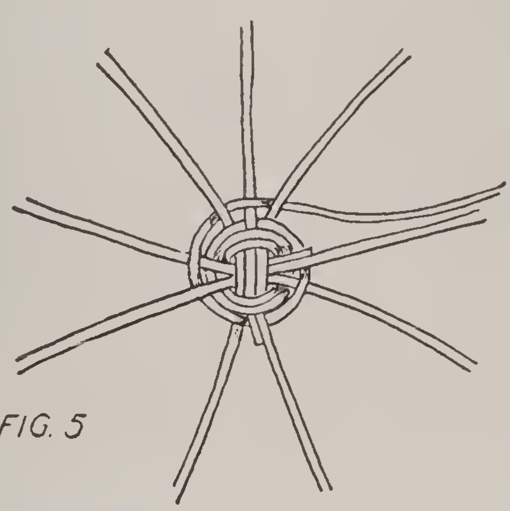


FIG. 5

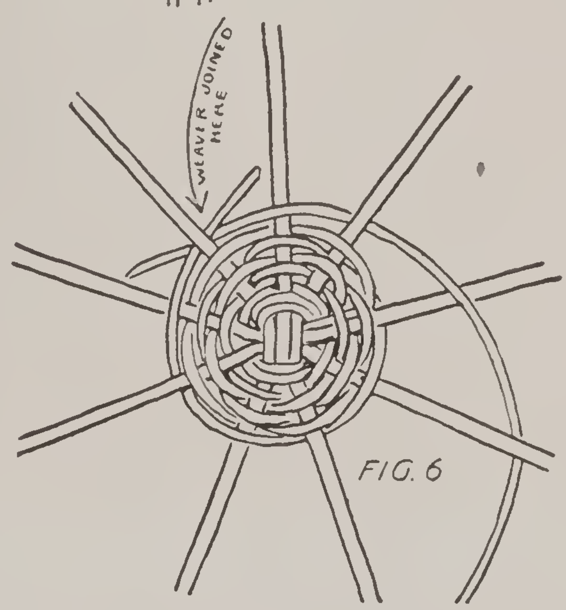


FIG. 6

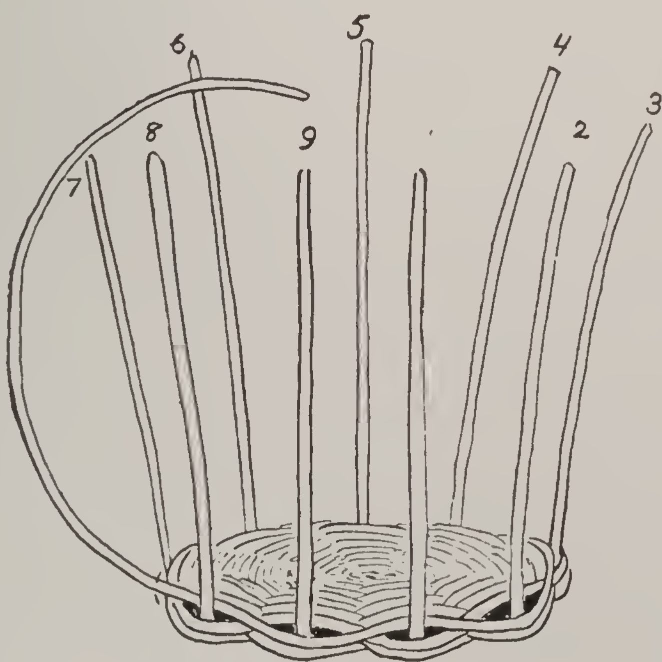


FIG. 7

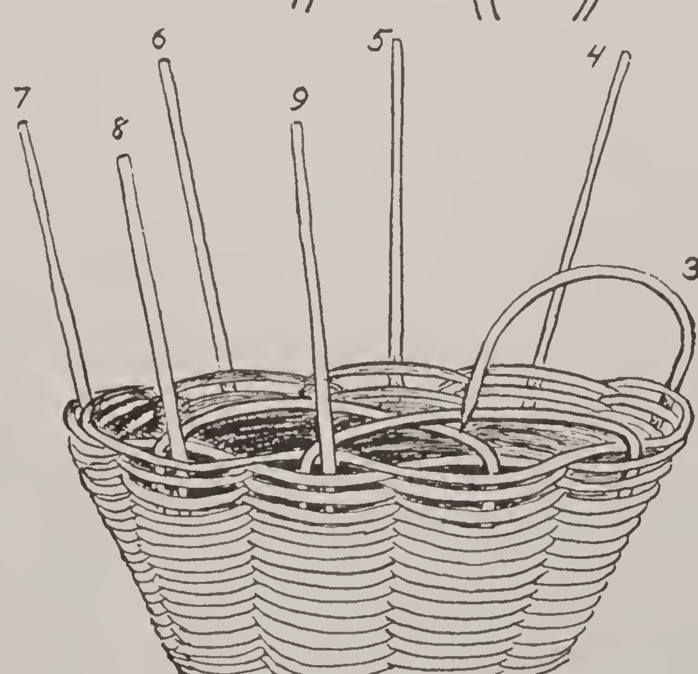


FIG. 8

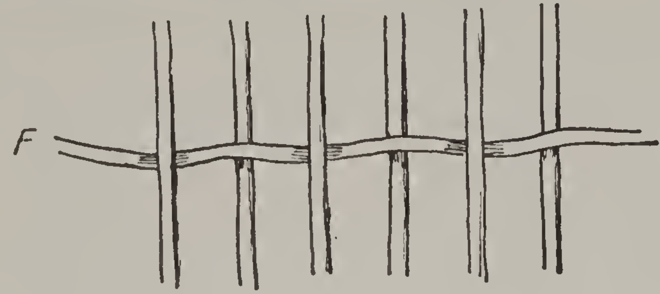


FIG. 9

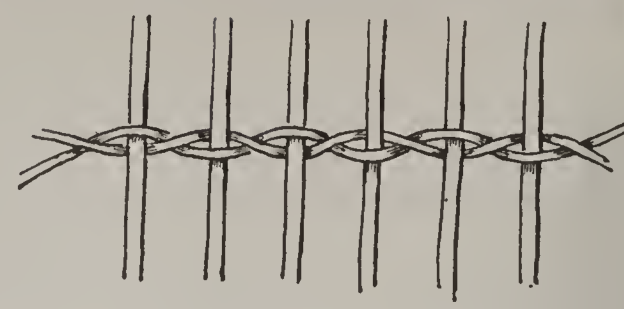


FIG. 11

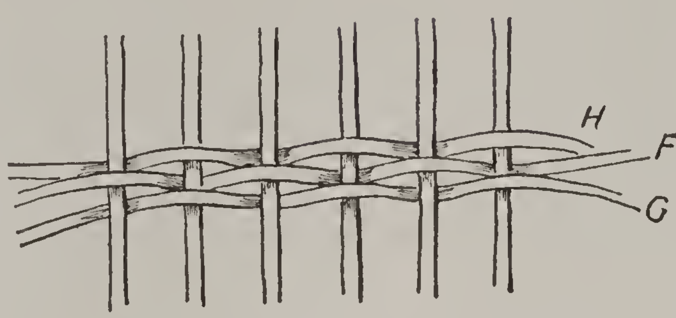


FIG. 10

cut four spokes of No. 3 reeds, each spoke 14 inches long. Cut one more spoke of No. 3 reeds, but make it only 8 inches long. Now from your bunch of No. 2 reeds draw out two strands. These two reeds are the "weavers." Coil each weaver into a circle about the size of a breakfast plate, and run the ends in and out the coil, to keep them from unrolling.

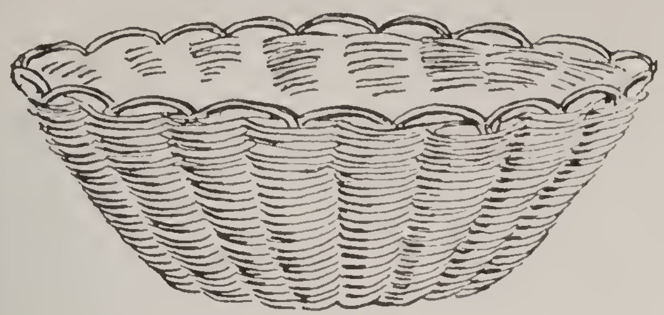
Soak all this material in cold water for about an hour. When pliable place two 14-inch spokes down flat, close together, side by side on a table or a board (*A* Fig. 1). Across the center of these lay two 14-inch spokes (*B* and *C* Fig. 1) and slide the 8-inch spoke *D* between *B* and *C*, Fig. 1. The end of *D* extends a little beyond the center.

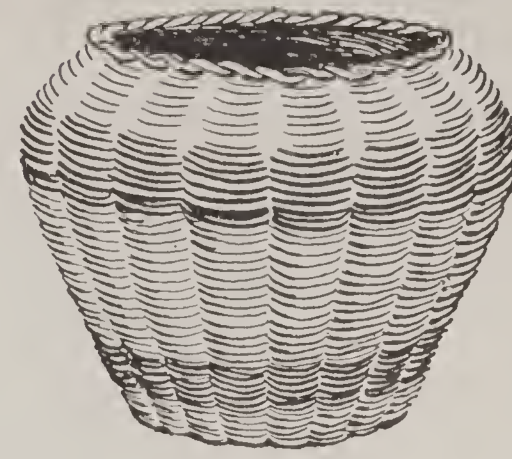
Hold the five spokes firmly in position with your left hand while weaving with the right. Begin by fitting one end of the weaver under the three top spokes, and close to the two under spokes, with its extreme end pointing toward the right (*E* Fig. 2). Loop the long end of the weaver over the three spokes, *B, C, D,* where they meet the two cross reeds, flatten with your thumb and finger and bring the weaver down under its own end *E,* also under the two reeds (*A* Fig. 2). Next carry the weaver over the three spokes (Fig. 3) down under the two spokes, up and over the three, down and under its own end *E* and two spokes *A,* up over the three and down under the two (Fig. 3). Now stop weaving a moment while you separate the three spokes *B, D, C* (Fig. 4). Then weave over, under and over these. Continue to separate all spokes as you reach them, and weave under and over (Fig. 5).

When a new weaver is needed join it on the last weaver by crossing their ends, as shown in Fig. 6. Hold the crossed ends steady with the left hand as you continue to weave.

As soon as the bottom of the basket is sufficiently large dampen the spokes, so that they bend easily, turn them up (Fig. 7) and keep on weaving until the sides are as high as you want them.

Finish the top of the basket by binding it off, with its own spokes. First cut off the extending ends of the spokes with a slanting cut, making them all the same length; hold them in water until pliable; then bend spoke No. 1 (Fig. 7) and run its point down into the opening made by spoke No. 8 (Fig. 8). Push spoke No. 2 into the weave by the side of spoke No. 9. Run spoke No. 3 down by the side of spoke No. 1 (Fig. 8). Bend down and slide in all the remaining spokes in like man-





Here are the Finished Baskets

ner, and your basket will be finished.

Fig. 9 shows the simple weaving in and out with one reed *F,* and a number of spokes. Fig. 10 gives the same with the weave *H* above and the weave *G* below. Fig. 11 is the pairing weave, often called primitive weave. In this two weavers are used at the same time and crossed between each spoke.

After you have had a little practice with the simple weave, you will be ready to try your skill in making experiments with the pairing weave.

Bead Weaving

Make your own bead loom of a smooth piece of wood about 12 x 3 inches or wider and ¼-inch thick (Fig. 12). On top of each end fasten a small block of wood 1 inch high, ¼-inch thick and 4 inches long. Tack these uprights in place with slender brads.

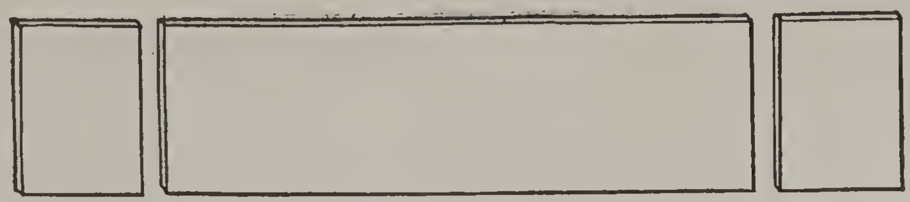
Carefully hammer in a row of slender, headless nails along the top edge of each upright *I* and *I* (Fig. 13), allowing the nails to go in only deep enough to hold firmly. Hammer also a large headed tack on the outside of each upright midway between the top and bottom (Fig. 13).

Use strong waxed linen thread for weaving. Tie the long threads all together at one end and call them the "warp." Always allow one more warp thread than your number of beads in the width of belt or chain you intend to weave.

Fasten the knot of warp ends on the large headed tack (Fig. 13) and carry the threads over the top of the upright (Fig. 13), running them between the nails (Fig. 13 and Fig. 14). Stretch the threads across to the opposite upright between the nails (Fig. 13) and bring them down on the outside of the upright, where you must fasten them to the big-headed tack.

The warp threads may be as long as you wish. After stretching them across the loom and attaching them to the large tack, wind the extra length on a piece of paper and fasten it to the loom under the large-headed tack, ready to use when needed.

If you have 8 warp threads across



END UPRIGHT

FIG. 12
STRIP OF WOOD FOR BOTTOM OF BEAD LOOM

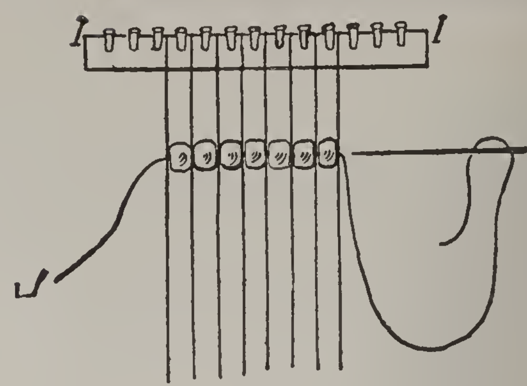


FIG. 14

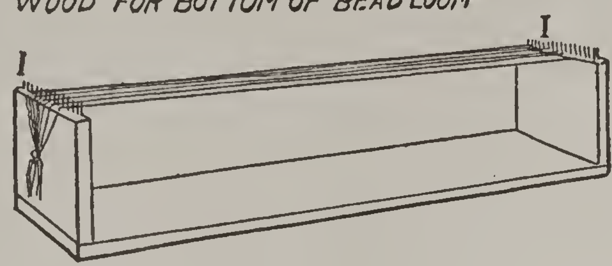


FIG. 13

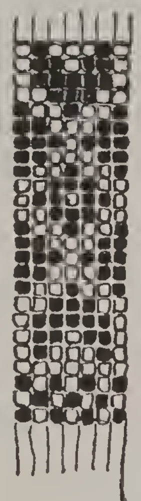


FIG. 15

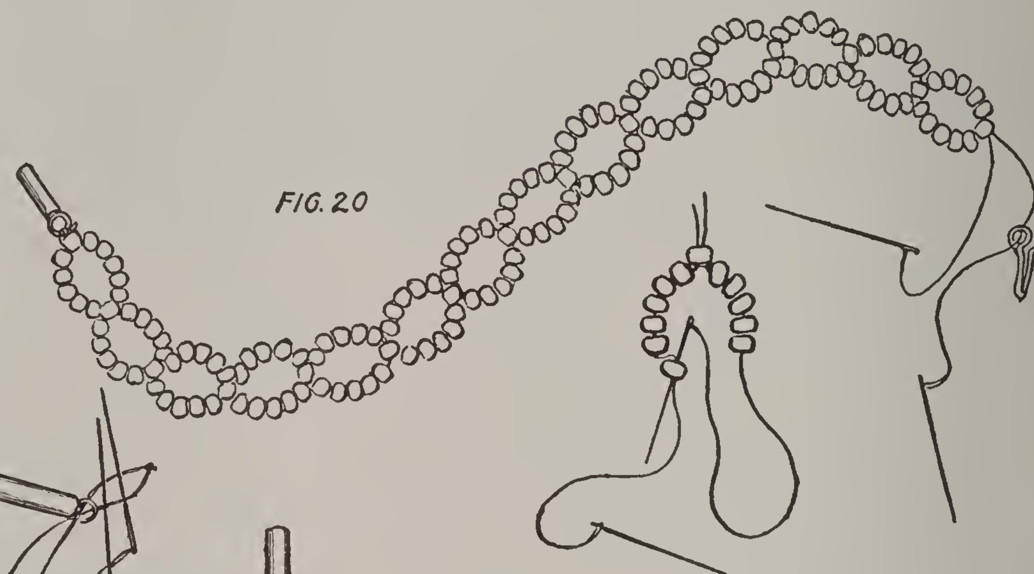


FIG. 20

FIG. 16

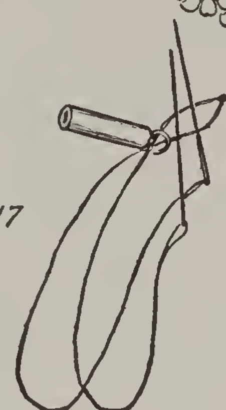


FIG. 17

FIG. 19

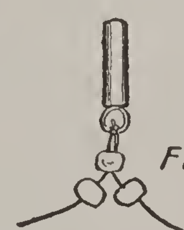


FIG. 18

the loom, string seven beads with needle and thread. This thread is your *"weft."* Warp runs lengthwise and weft goes crosswise.

Place these weft thread beads *underneath* the warp threads, adjusting the beads so that they can be pushed up between the warp threads and held up by a finger of the left hand (Fig. 14) while you bring the weft threaded needle back through the beads again, *on top* of the warp threads, and in this way sandwich the row of warp threads between two weft threads.

Tie the loose end of the weft I, Fig. 14, to the thread in the needle, and the first row of beads will be woven. String seven more beads and weave them as you did the first ones. Continue to repeat the process until the fob, belt or chain is finished.

Fig. 15 gives a portion of a woven bead belt made of white, red, yellow and black beads. The same pattern can be used for other colors.

With two threaded needles and good sized beads you can fashion a charming necklace. Choose beads of any color or colors you like, have ready a clasp (Fig. 16) and begin work.

Tie the ends of the double waxed thread in each needle together. Run this knot through the loop on one end of the clasp (Fig. 16) and pass the two needles through the extended thread loop (Fig. 17). Draw the knot tight on the metal loop, and thread both needles through the same bead. Then separate the needles, threading each through a different bead (Fig. 18). Run four more beads on each needle and again pass

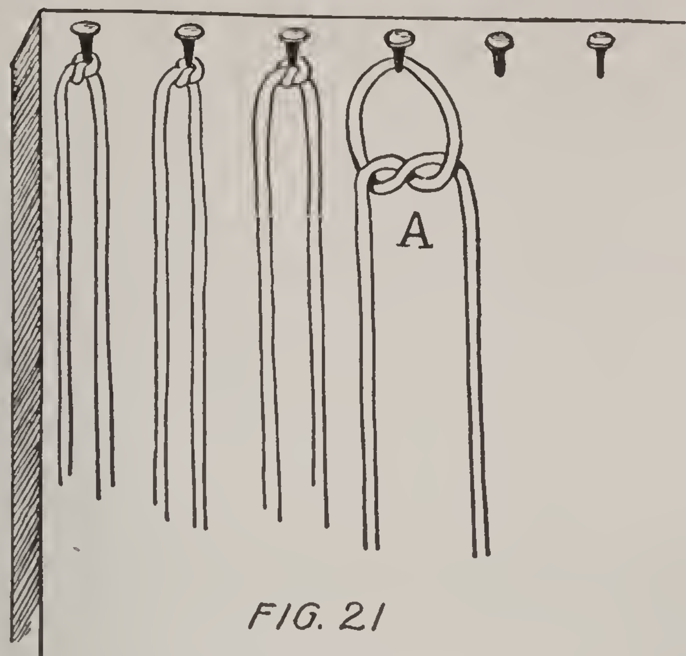


FIG. 21

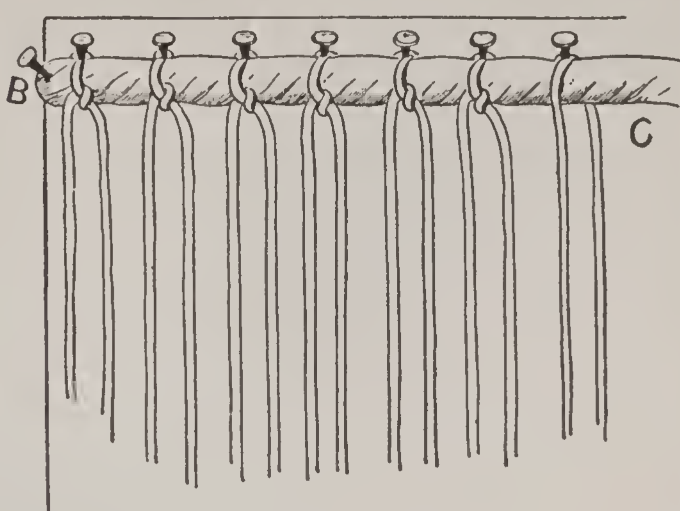


FIG. 22

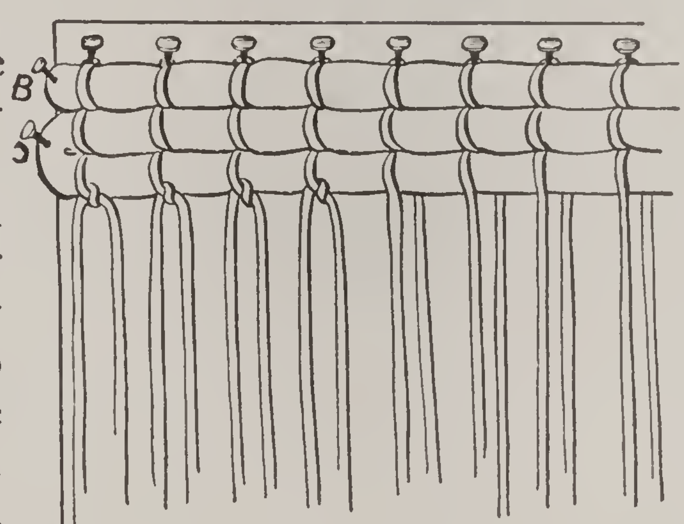


FIG. 23

the two needles through the same bead (Fig. 19) after which thread each separate needle with five beads and bring the beads together by running the two needles through the same bead. Keep on making these bead rings until the necklace is long enough. Finish by sewing on the catch half of the clasp (Fig. 20).

One word of caution: Always work with medium sized, or better still, large sized beads. Avoid the fine, small beads if you value your eyesight. Remember that good eyesight is worth more than all the beads in the city.

Weaving a Craft Portiere

Soft, loosely twisted mop rope and soft, coarse twine with some large glass beads of various colors are the materials you will need for your decorative, strong, substantial portiere.

Have ready an ordinary smooth board several inches longer than the width you want the portiere. On this rule a lead pencil line one inch from the top edge and reaching from end to end of the board.

Drive a row of tacks along the pencil line ¾ inch apart, and on each tack tie the center of a long piece of soft twine. Have the twine vary in length that the joinings may not come in a row, when more twine is added.

Fig. 21 shows a portion of the board with tacks in place and twine tied on the first three tacks. On the fourth tack (*A*) the twine is tied loosely, ready to be drawn tight; twine has not yet been fastened on the remaining tacks.

Fold in separately the loose ends of strands composing the mop rope end, and fasten them in place with strong needle and thread. Then begin weaving. Place the rope end up close to the first tack and hold it in position with an extra tack (*B,* Fig. 22) while you bring the rope across to the opposite end of the board, keeping it well up against the tacks. Draw the rope only tight enough to prevent sagging, and fasten it at the opposite end of the board with another tack. Then place the rope in between the two lengths of twine

hanging from each tack. Tie the different strands of twine around the rope (Fig. 22). *C* (Fig. 22) gives the rope in place but not yet tied with the twine. Continue tying in the rope until the entire stretch of rope is fastened between the twine.

When the opposite end of the board is reached, bend the rope as at *D* (Fig. 23) and turn it back across the board, securing it with an extra tack, as shown in *D* (Fig. 23). Again

The Finished Portiere

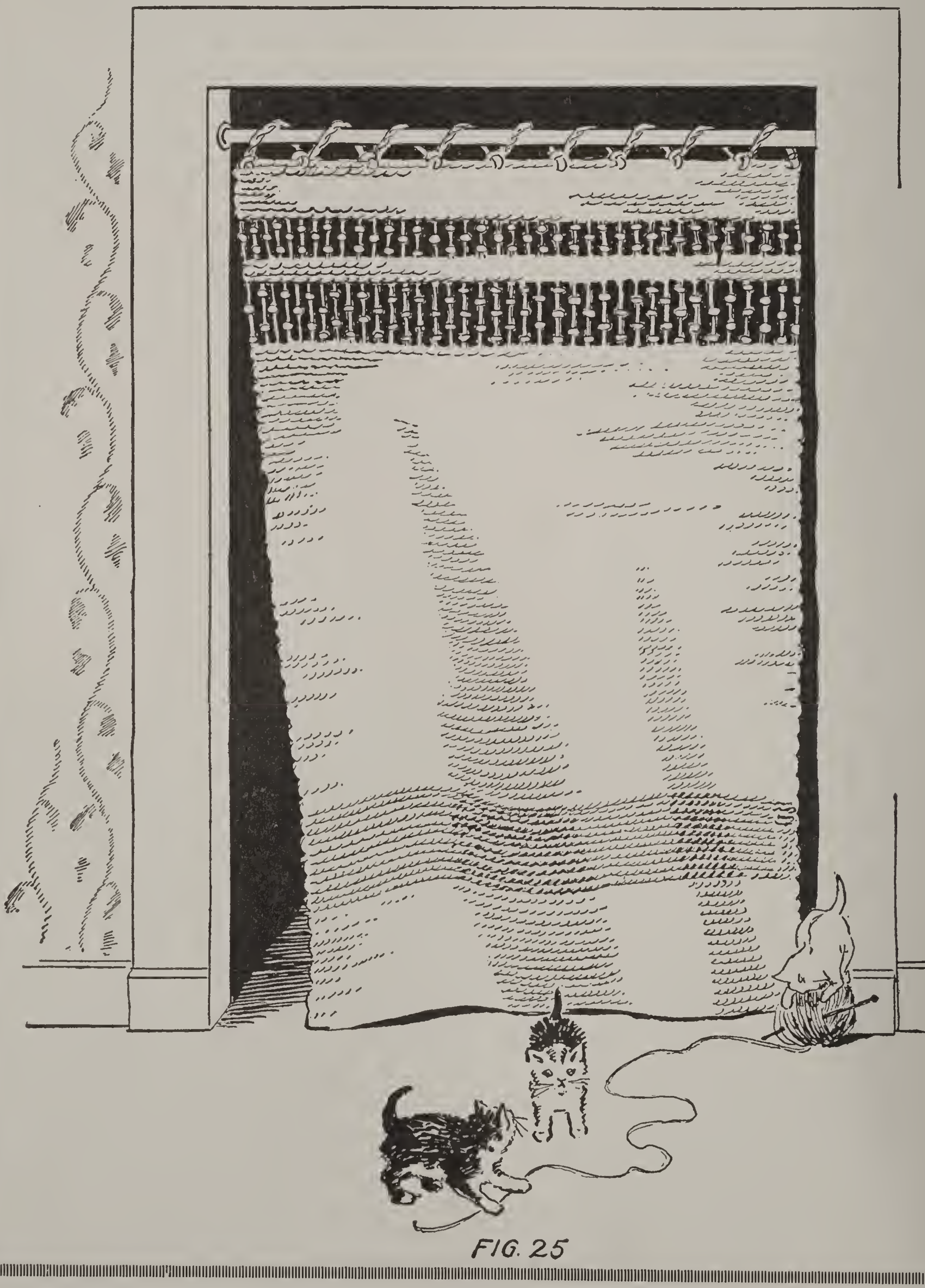


FIG. 25

adjust the strands of twine over and under the rope and tie. As soon as the second row is tied make a third row (Fig. 23). Weave back and forth in this way, from end to end of the board to the depth of about 8 inches. Then instead of single knots make the last row of knots double—a "hard knot" or a "square knot."

Cut off the remaining rope and fasten the strands of the rope end with thread and needle. Your weave

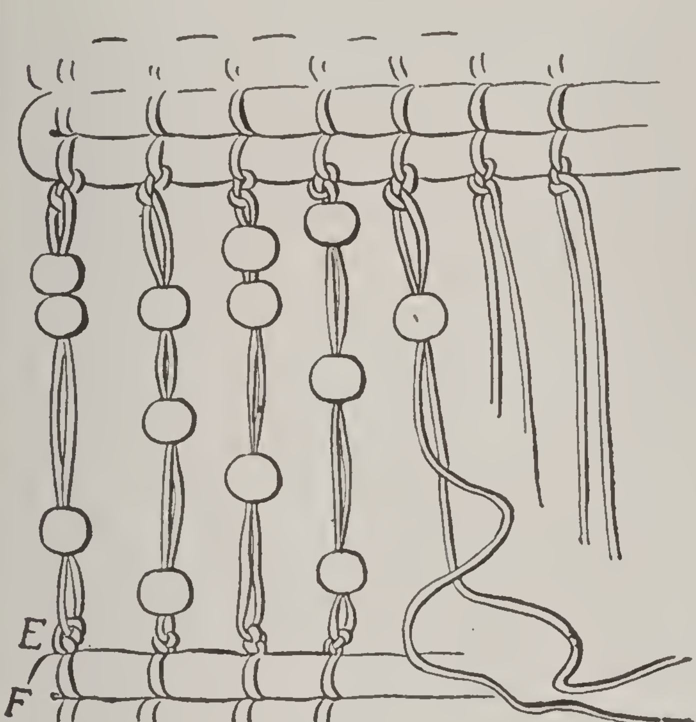


FIG. 24

is now ready for the beads. Moisten the two ends of the first piece of twine hanging from the first double knot, and with thumb and first finger, roll the two damp ends together into a sharp point, thread the point through a red bead, allowing 3½-inch length of the twine, then slide on a green bead and near the bottom another red one; tie the bottom ends of the twine into a double knot (*E*, Fig. 24). Have all the hanging twine 3½ inches in length from the top knot to the bottom one.

String a green bead, a yellow one and a purple one on the next double twine. Keep stringing various colored beads in this way until the band of beads is finished. Then weave a solid rope band about 2½ inches wide; next a bead band 5½ inches, using several beads on each double twine. Keep the beads at irregular distances apart.

Fig. 24 shows four strands of beads as they should be when finished, the fifth double strand gives only the first bead in place, and the remaining strands are not yet beaded.

Weave solid rope band next and

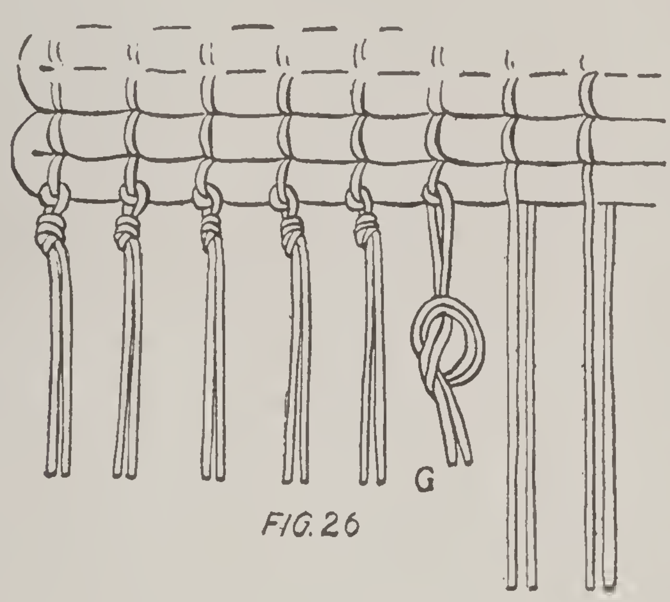


FIG. 26

weave to depth you wish the length of your portiere.

Other kinds of soft rope or heavy cord may take the place of mop rope if desired, and the design varied by having a darker weave a short distance from the bottom (Fig. 25).

If fringe is needed on the bottom of the hanging, make it as in Fig. 26. Here *G* shows exactly how to tie the twine fringe. When finished trim off evenly.

As soon as the weave of the portiere is deep enough to reach to the bottom edge of your board, remove the tacks and shove the work up, bringing the greater portion of the finished weave over the top edge of the board, fasten again with tacks

The Portiere Loops

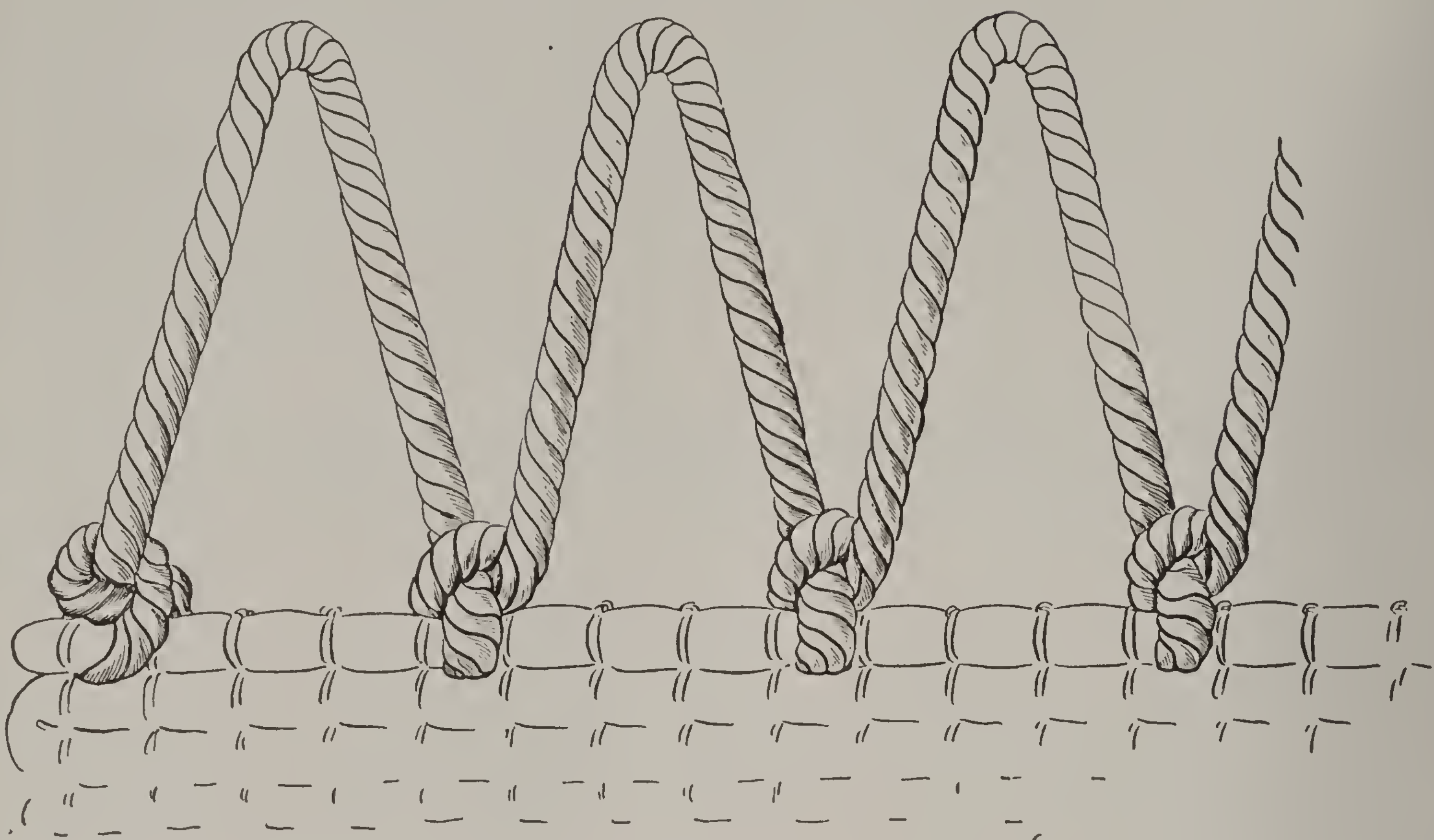


FIG 27

(only enough to hold it firm), while you continue the work.

Loops by which to hang the portiere are shown in Fig. 27. One end of a piece of rope is pushed through between the first and second weave and tied.

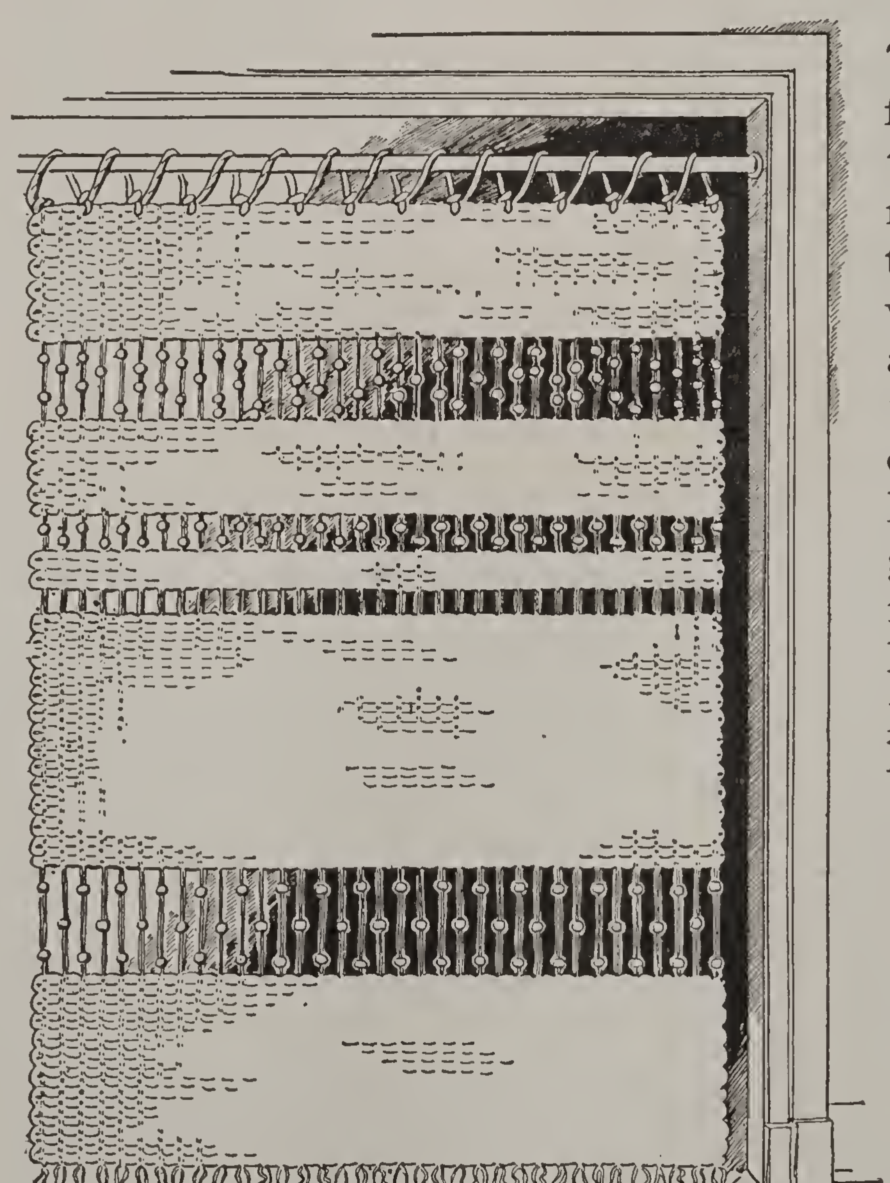


FIG. 28

How the Portiere Is Hung

Then 3 inches from the first tie, again the rope goes between the weave, is tied after allowing a 10-inch length of rope for the loop. Fig. 28 gives the method of hanging the portiere by the loops.

Things to Make of Paper

LISTEN! This is what the enthusiastic little maid in the picture is saying to you:

"See all these pretty things? I made them of paper. Aren't they lovely? You try too, it is such fun, and the work so quick. My paper canoe looks exactly like the real one we have at camp, and the butterfly is precisely the shape of the one I made friends with last summer. But I must not talk more for it's time to get to work."

The Canoe

Trace a pattern for the boat, Fig. 1, on smooth paper. Fold the paper first, then mark an outline of the canoe on one side, Fig. 2. Cut it out, open, and you have Fig. 3. Lay this pattern flat on heavy white paper, run a pencil line around the edge, and cut it out. Paint the canoe to resemble birch bark and close the open ends by overhanding the edges of the sides together with color-


FIG. 1. THE CANOE FINISHED

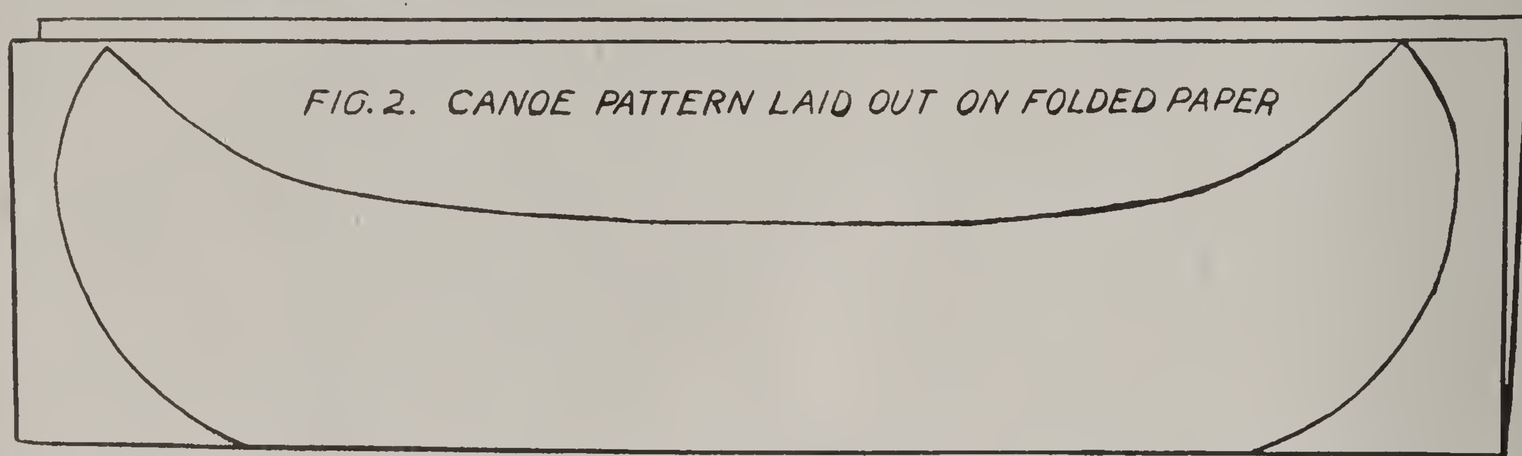


FIG. 2. CANOE PATTERN LAID OUT ON FOLDED PAPER

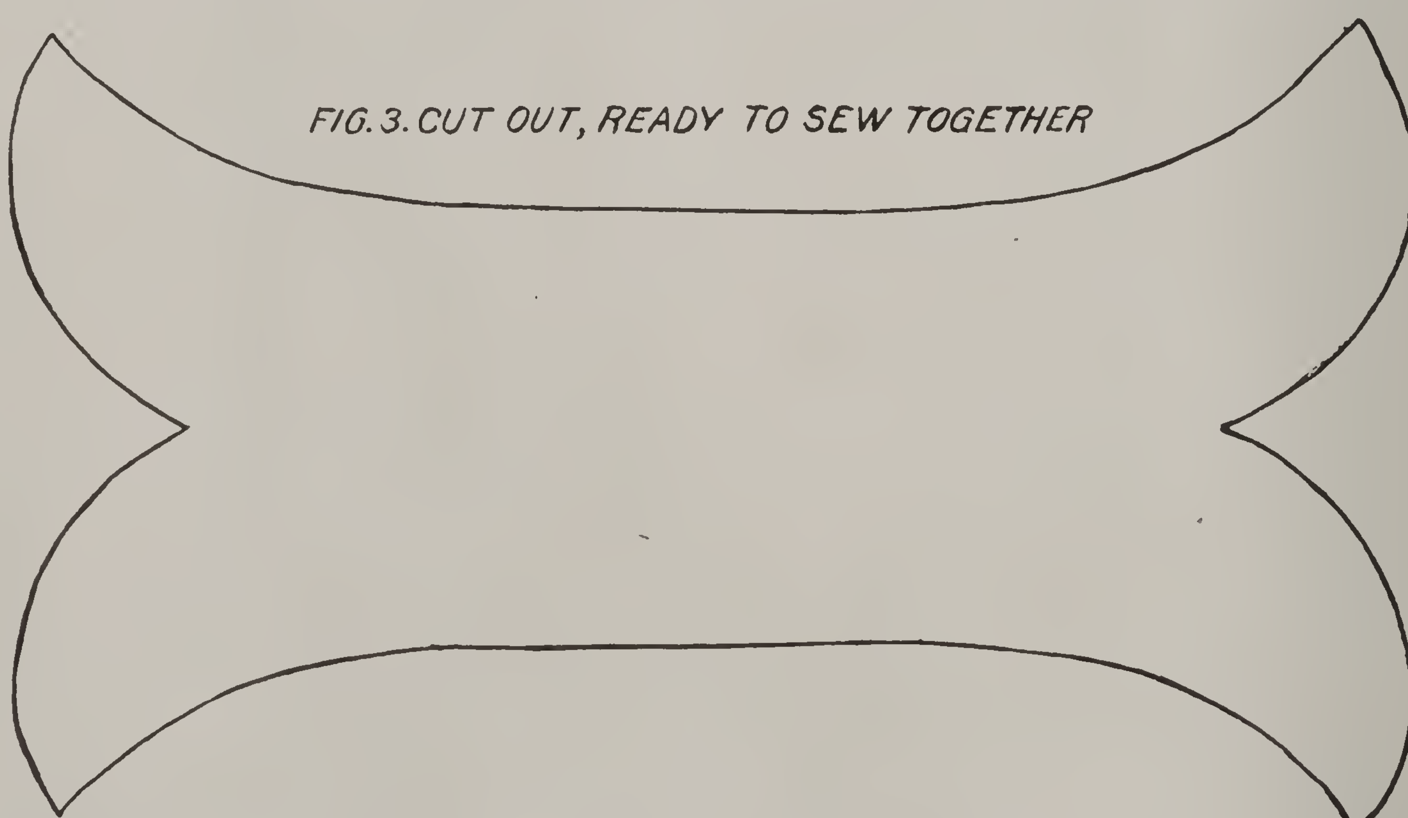


FIG. 3. CUT OUT, READY TO SEW TOGETHER

ed floss in widely separated stitches. Use blunt end wooden toothpicks as props to keep the central sides of the canoe apart.

Butterflies

You will want a number of these, and Fig. 4 gives the outline pattern on folded paper. Fig. 5 shows the butterfly cut out, and Fig. 6 gives it bent and ready for flight.

Suspend a group of these fairy-like creatures with fine black threads of different lengths and not too close together, then watch them fly and flutter with every motion of the air. The butterflies are especially attractive made of smooth tissue paper of varying tints, and even though conventionalized in regard to color and the absence of characteristic markings, they are very effective.

Bird

Let the bird, Fig. 7, be of stiff paper. Fig. 8 is the pattern on

A Bird and a Butterfly

FIG. 4

FIG. 5

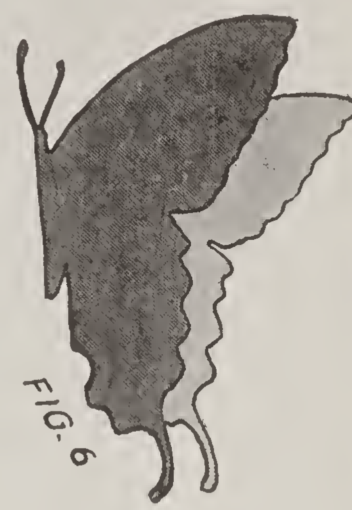


FIG. 6

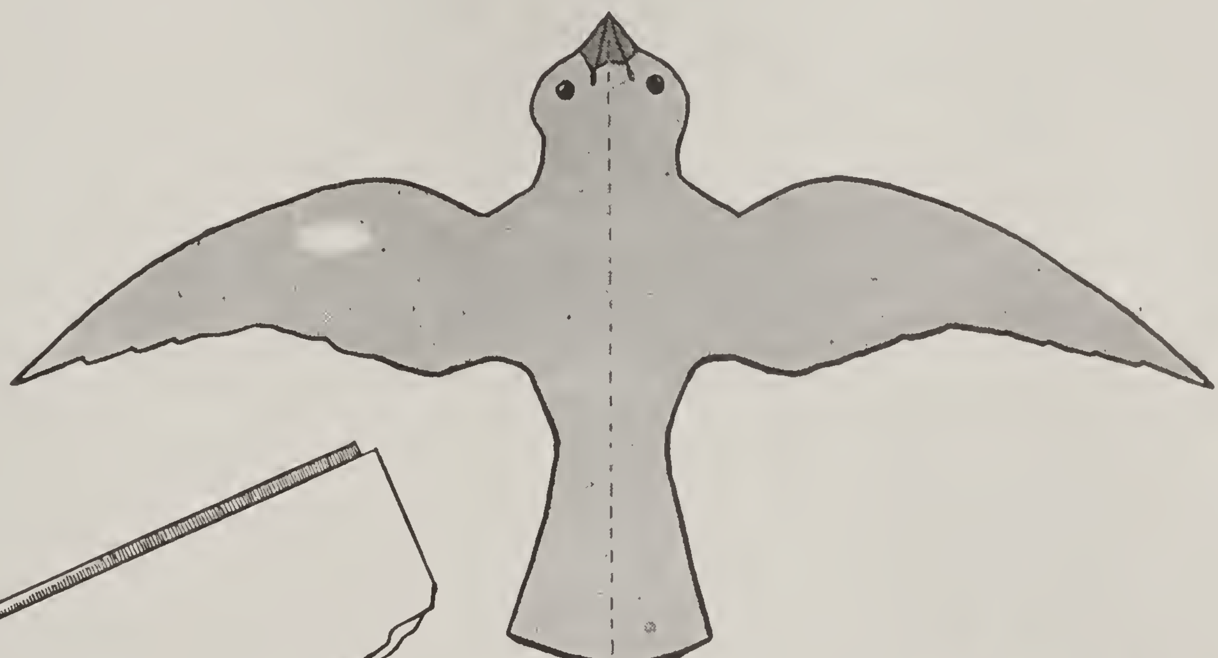


FIG. 8
YOUR CUT OUT BIRD
READY TO BEND INTO SHAPE

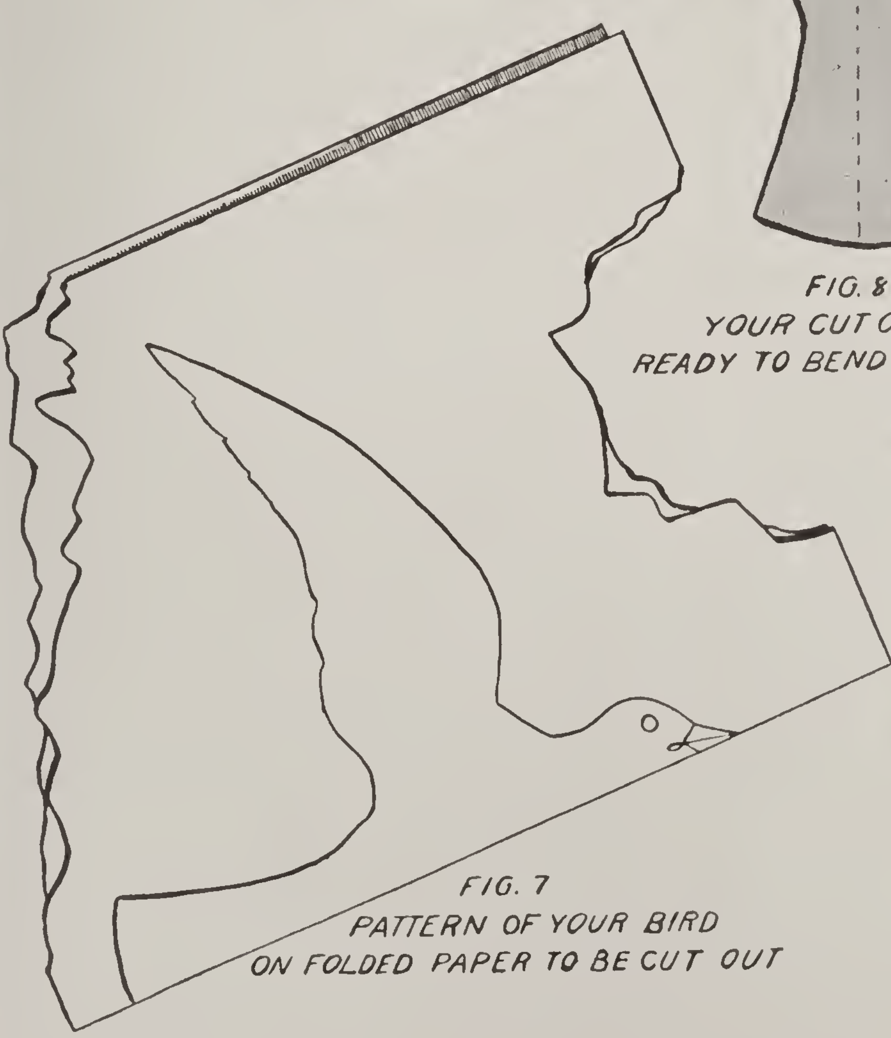


FIG. 7
PATTERN OF YOUR BIRD
ON FOLDED PAPER TO BE CUT OUT

FIG. 9
YOUR FINISHED
PAPER BIRD

Making a Paper Rose

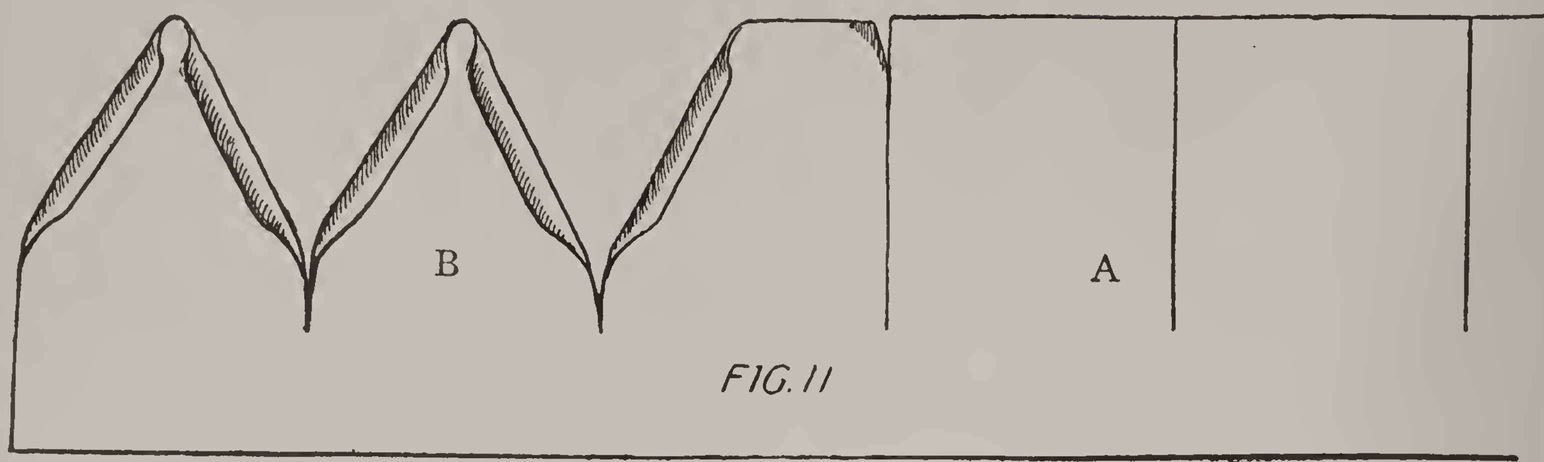


FIG. 11

FIG. 10

folded paper, and Fig. 9 the bird cut out with beak and eyes marked, dotted line indicating where to bend the bird through the center. As this is a conventionalized bird it is not intended to represent any particular species, but it may be any kind you wish. A flock of blue birds, "for happiness," can be made of blue book-cover paper, and the same pattern with scarlet paper gives scarlet tanagers. Paint the wings and tails of the tanagers black. Many other varieties of wild birds may be made with different colored papers.

After bending each bird, paste the two sides of the head together, leaving the body and tail merely bent. The birds, though all from one pattern, look entirely unlike when made of different colored papers and are very lifelike in appearance. They may be fastened on a natural branch, suspended in the air by threads, and can also be used as place cards.

A Paper Rose

The pretty, large-sized paper rose, Fig. 10, can be pink, white, red or yellow, and even variegated like our rare York and Lancaster rose.

Use heavy wire wound with green tissue paper for the stem, and form the rose petals of strips of smooth, slashed tissue paper, the slashes being 2½ inches wide and 2½ inches deep, Fig. 11A.

With the blade of a dinner knife curl the two top corners of every

A "Strawberry" Basket

Fig. 12

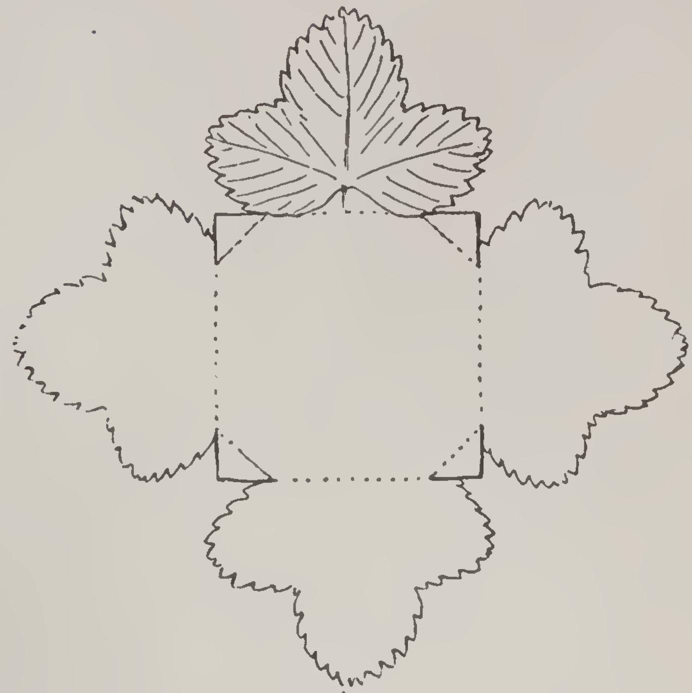


Fig. 13

petal by drawing the petal between the knife blade and finger, Fig. 11B.

Wad tissue paper on the end of the wire stem, and on this as a foundation wind the rose petals around and around, gathering the bottom edge of the petal strip as you paste the petals in place.

Strawberry-Leaved Basket

A dainty little strawberry-leaved basket, Fig. 12, is just what you want for serving individual portions of fresh, unhulled strawberries or for candied strawberries.

Trace the pattern, Fig. 13, on stiff paper, cut it out, mark the veining of the leaves as in C, Fig. 13. Bend up sides and corners at dotted lines and with a stitch or two of thread fasten the corners of the basket together. Make this leaf basket of white paper and paint it light green, veining the leaves in a darker shade; or you can have it of green paper with leaf veining done in pen and ink.

The mayflower basket shown in Fig. 14 is an odd little affair; make one for each place at the luncheon table; have them of any color you choose, but let the paper be substantial and stiff. The sides look well either plain or decorated. Cut the basket from pattern, Fig. 15, bending all dotted lines. Paste the lapping bottom together, do the same with the two sides, and give the basket time to dry before using.

Another mayflower basket, Fig. 16, is equally charming. Mark a 5-inch square of paper, like Fig. 17. Cut heavy lines and bend dotted lines. The four corners, marked J, form the shelving triangles at top of basket. Use flowered, smooth paper in making these baskets, or white water color paper on which you can paint little rosebuds, powdered over the surface. Slide the ends of the handle, Fig. 18, in slits H and E, Fig. 17; this finishes the work.

Mayflower Basket

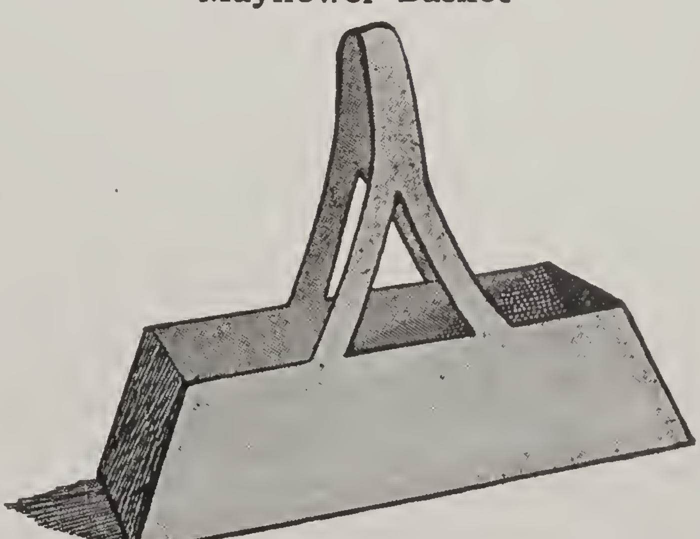


Fig. 14

Pattern for a Mayflower Basket

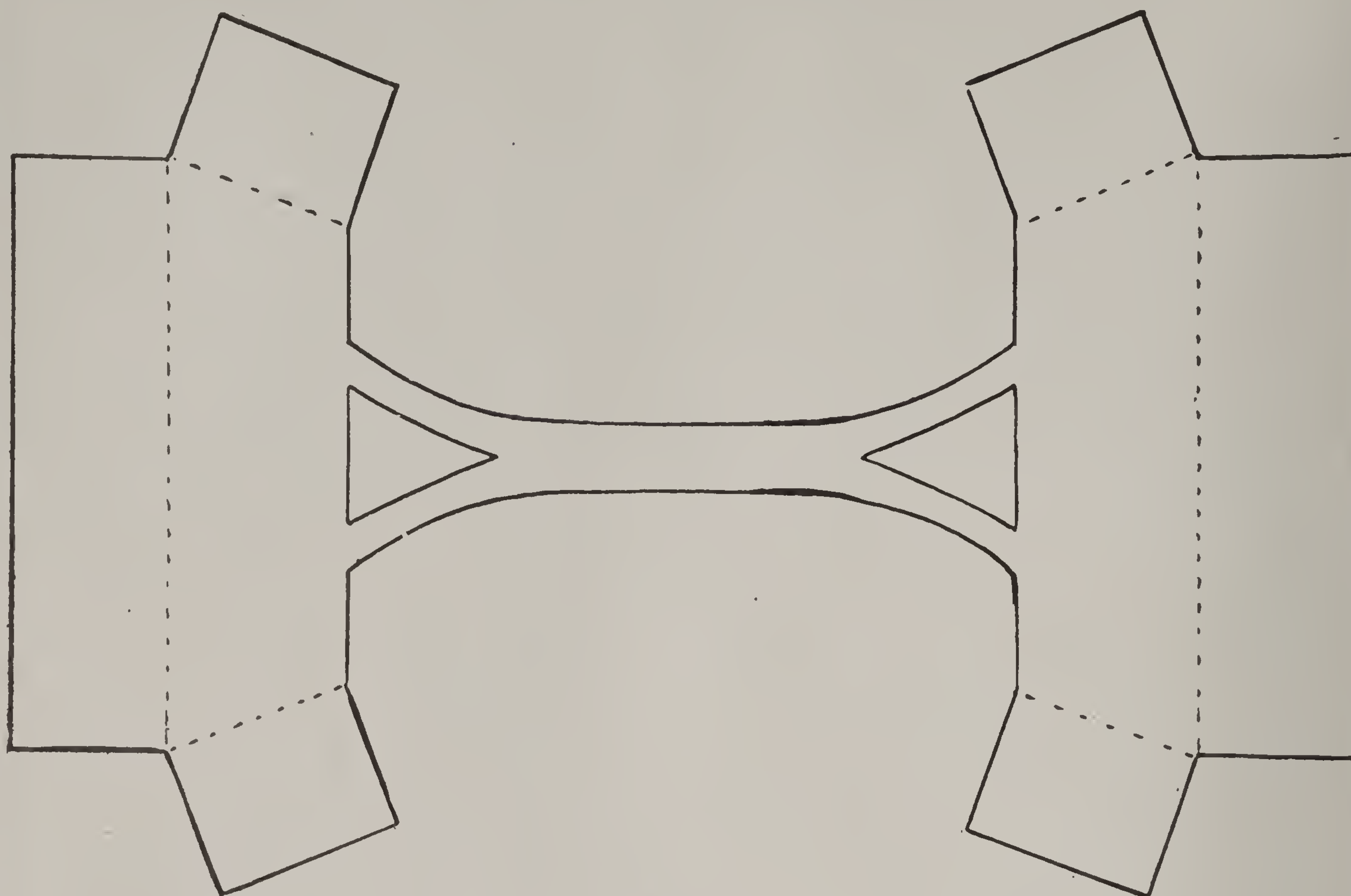


Fig. 15

A Paper Vase

The paper vase with classical lines, Fig. 19, must be of solid colored, stiff paper—bookcover paper is best—cut like the pattern, Fig. 20. Dotted lines indicate the laps at back of vase. Glue these together, then turn the handles over and fasten them down on the sides of the vase, as in Fig. 19. Cut a disk of paper ¼ inch larger than the circumference of the bottom edge of your vase. Slash the edge, Fig. 21; fit the bottom on the vase and glue the slashes up on the outside of the vase. Cover with a strip of same paper.

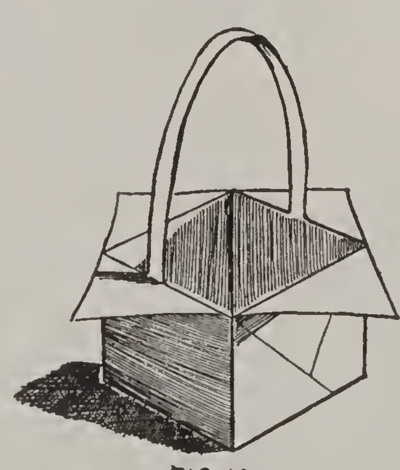


FIG. 16

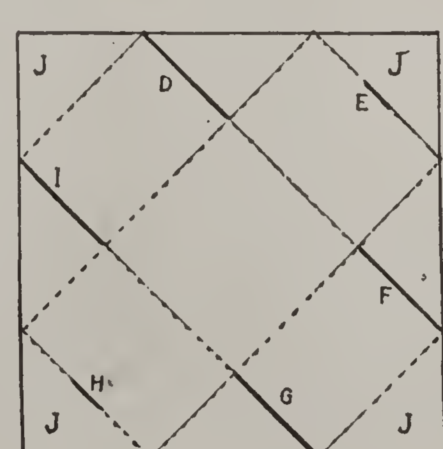


FIG. 17

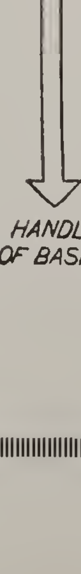


FIG. 18

HANDLE OF BASKET

You can make candle shades of paper that are as cheerful, pretty and attractive as those of silk or other material, and are inexpensive and easy to make.

You will need circular pieces of paper for a number of the shades, and by following directions given here, you can readily turn a square piece of paper into a circular one.

Take a 9-inch

For the Paper Vase

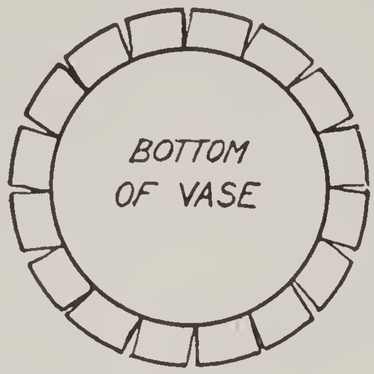


FIG. 21

FIG. 19

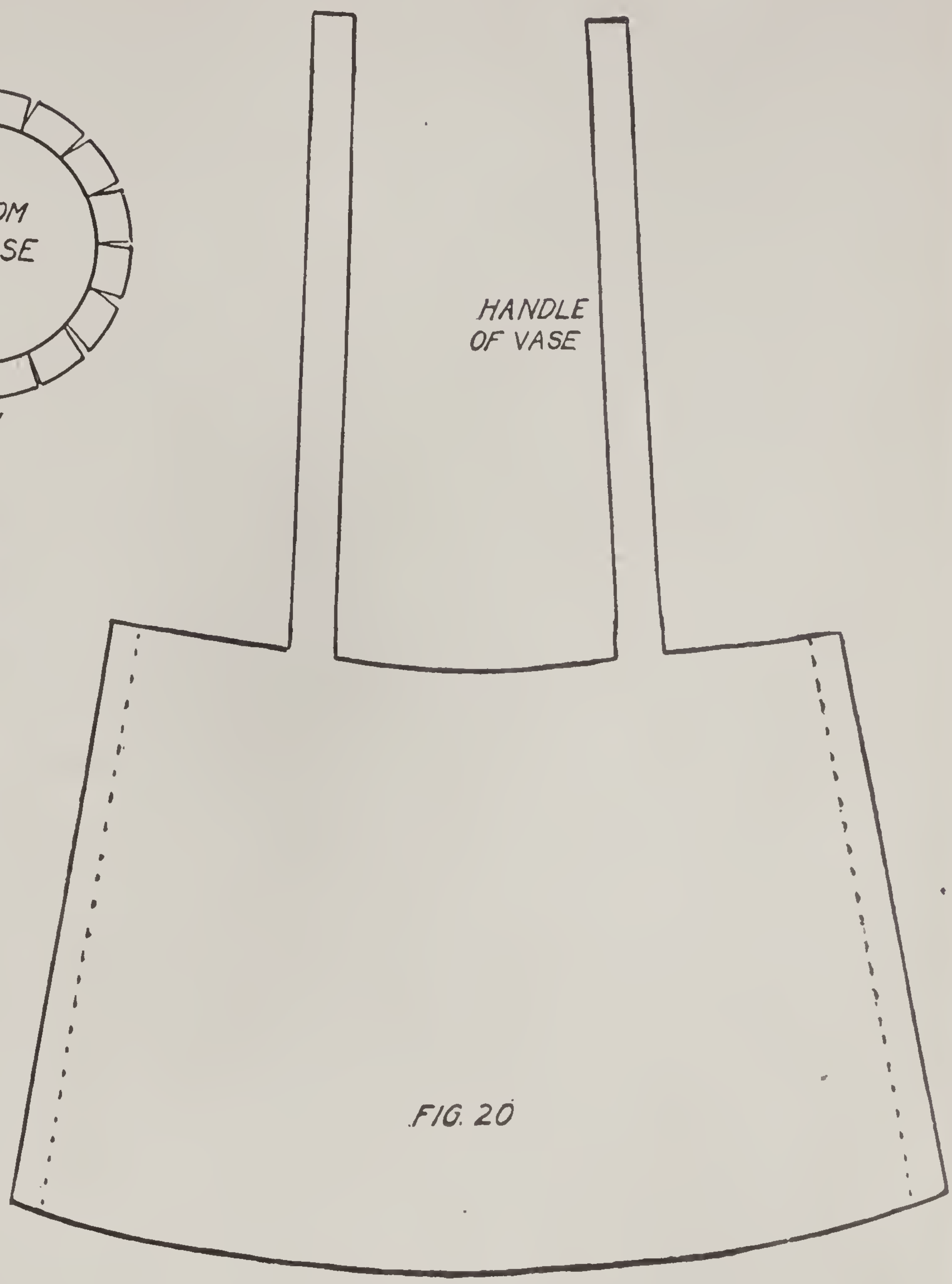


FIG. 20

square of paper, fold at center as shown in Fig. 23. Fold this at dotted line across center and it makes Fig. 24. When this is folded diagonally at dotted line, it gives Fig. 25, and by folding again, you get Fig. 26. Cut Fig. 26 across the two dotted lines, top and bottom, open out, and you have the circle with open center, Fig. 27. Smooth this pattern out flat and use it as a guide for making some of your lamp shades. The lines on the pattern are merely those caused by folding the paper.

Having cut out one shade from smooth rose colored paper, fold it across the center, making a half circle, again fold making a quarter circle, again fold and you have an eighth circle, Fig. 28. Unfold and lap each crease over ½ inch on bottom edge according to dotted line, Fig. 28. The next diagram, Fig. 29, shows the method. When finished, adjust the shade on the candle, Fig. 30.

Cut more disks of corn-colored paper for a different set of candle shades; fold each shade in accordion pleats like Fig. 32.

Again use the circular pattern for the pointed edge shade. Cut the

For Another Candle Shade

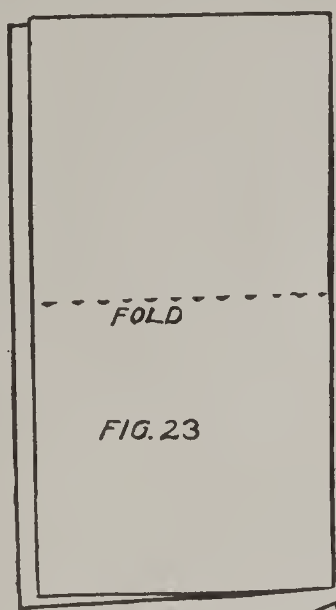


FIG. 23

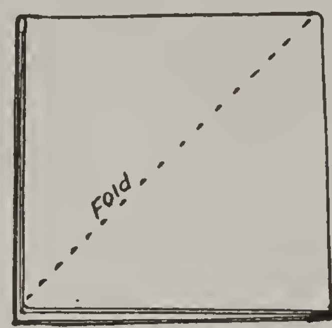


FIG. 24

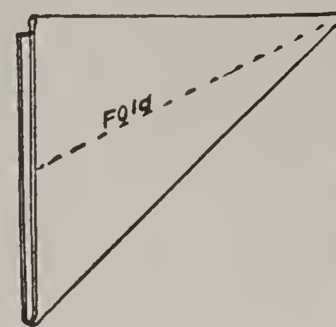


FIG. 25

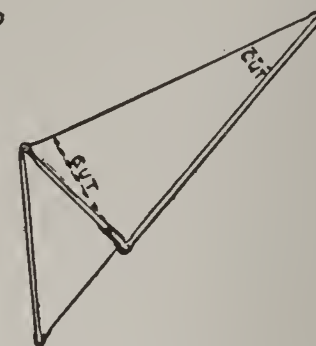


FIG. 26

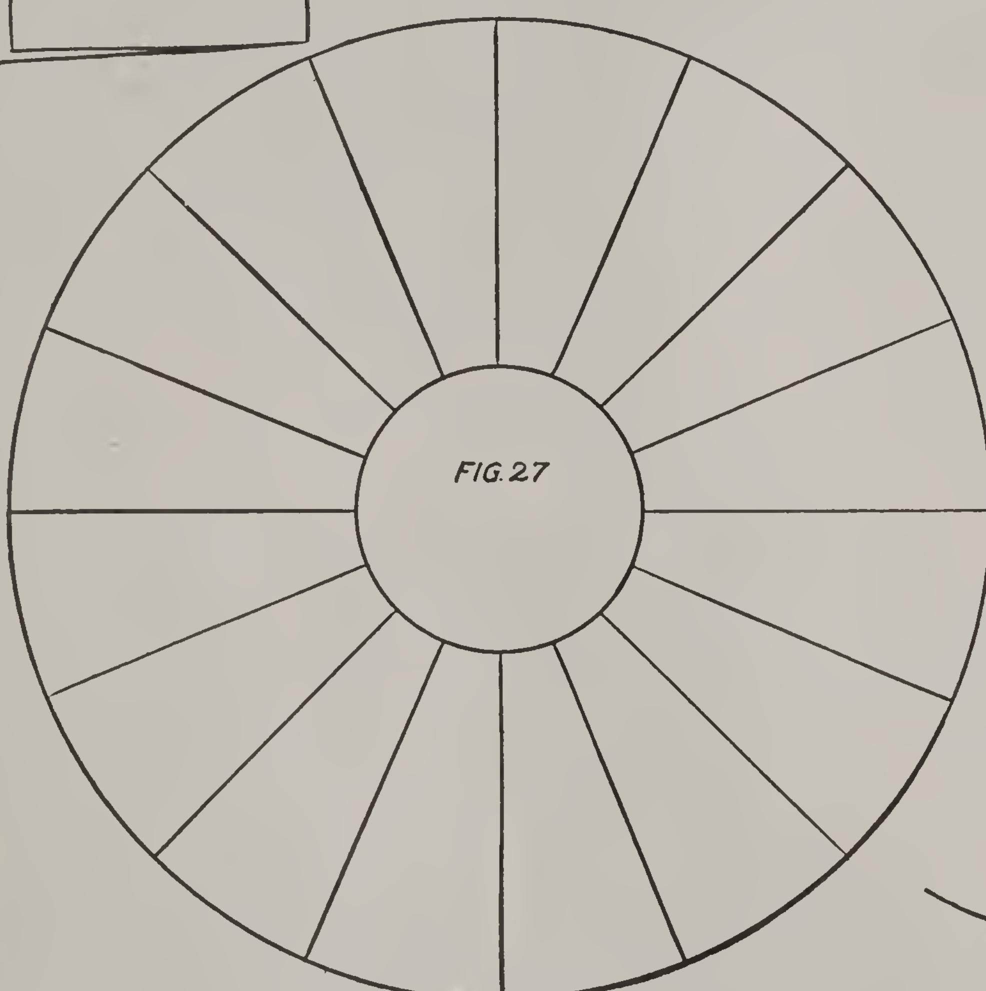


FIG. 27

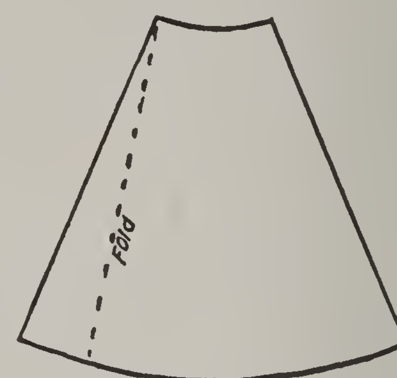


FIG. 28

FIG. 29

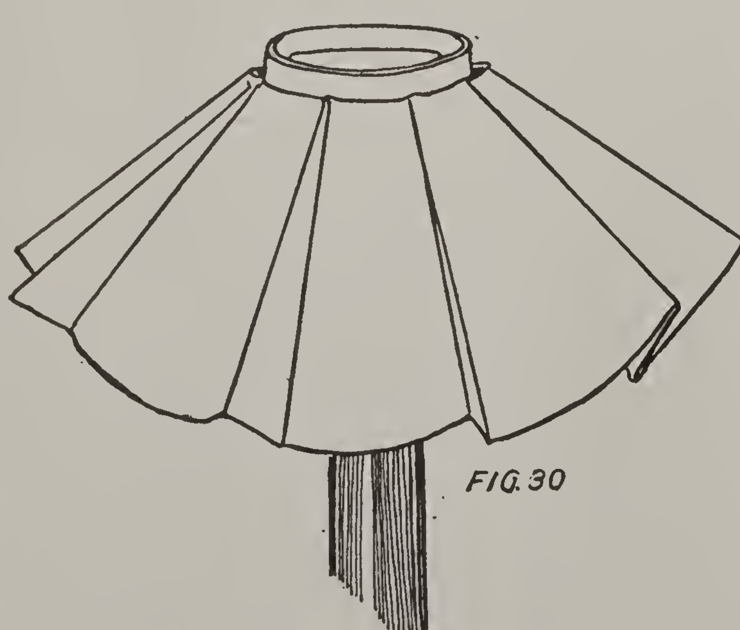


FIG. 30

A Pretty Lamp Shade

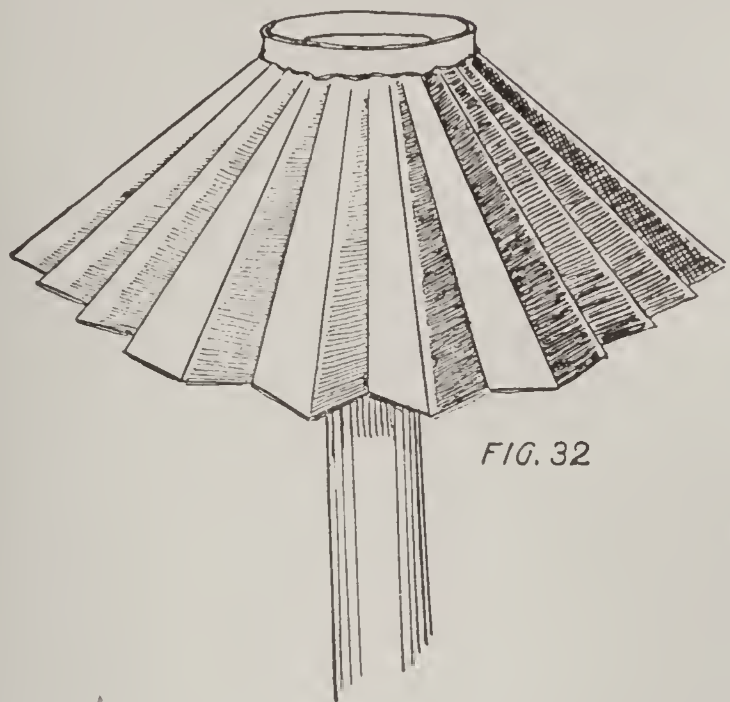


FIG. 32

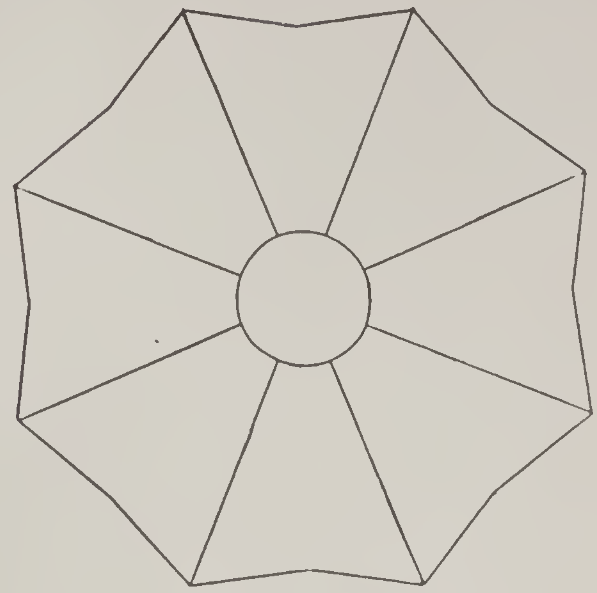


FIG. 34

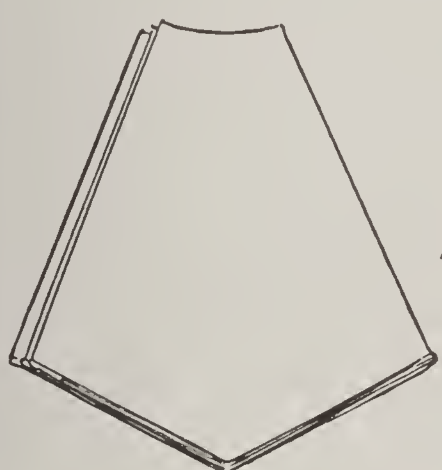


FIG. 33

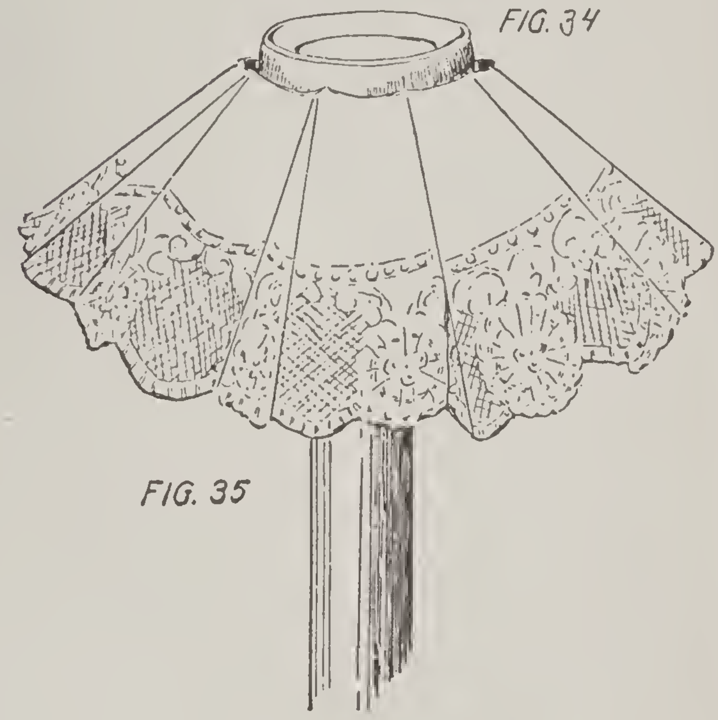


FIG. 35

disks from bright red paper, fold each shade in a half circle, then in a quarter circle, and lastly into an eighth of a circle, Fig. 28. Cut the bottom of this into one large shallow point, Fig. 33. Open out and you have Fig. 34. Lap as in Fig. 28 and 29. This makes a very pretty shade.

One of the most attractive and simplest shades is fashioned from a lace edged paper doily, Fig. 35. Cut an opening in the center of the doily candle shade, then lap the edge in pleats like Fig. 29. The lace edge of these shades can be tinted in different colors, combining variations of pinks and greens, yellows and browns, etc. Again, the lace can be all of one color or one tint.

The candle shade, Fig. 36, has a smooth surface without pleat or ruffle; Fig. 37 is the pattern. It is 3½ inches deep and measures 11 inches across the spread from corner to corner, from K to K. The back lap to be pasted on the opposite side is marked L.

Brightly colored birds cut from wall paper are pasted on the white paper shade. Other designs cut from old discarded magazines or flower catalogs can be used.

The paneled candle shade, Fig. 38, is stenciled with cunning little white bunnies on a light blue back-

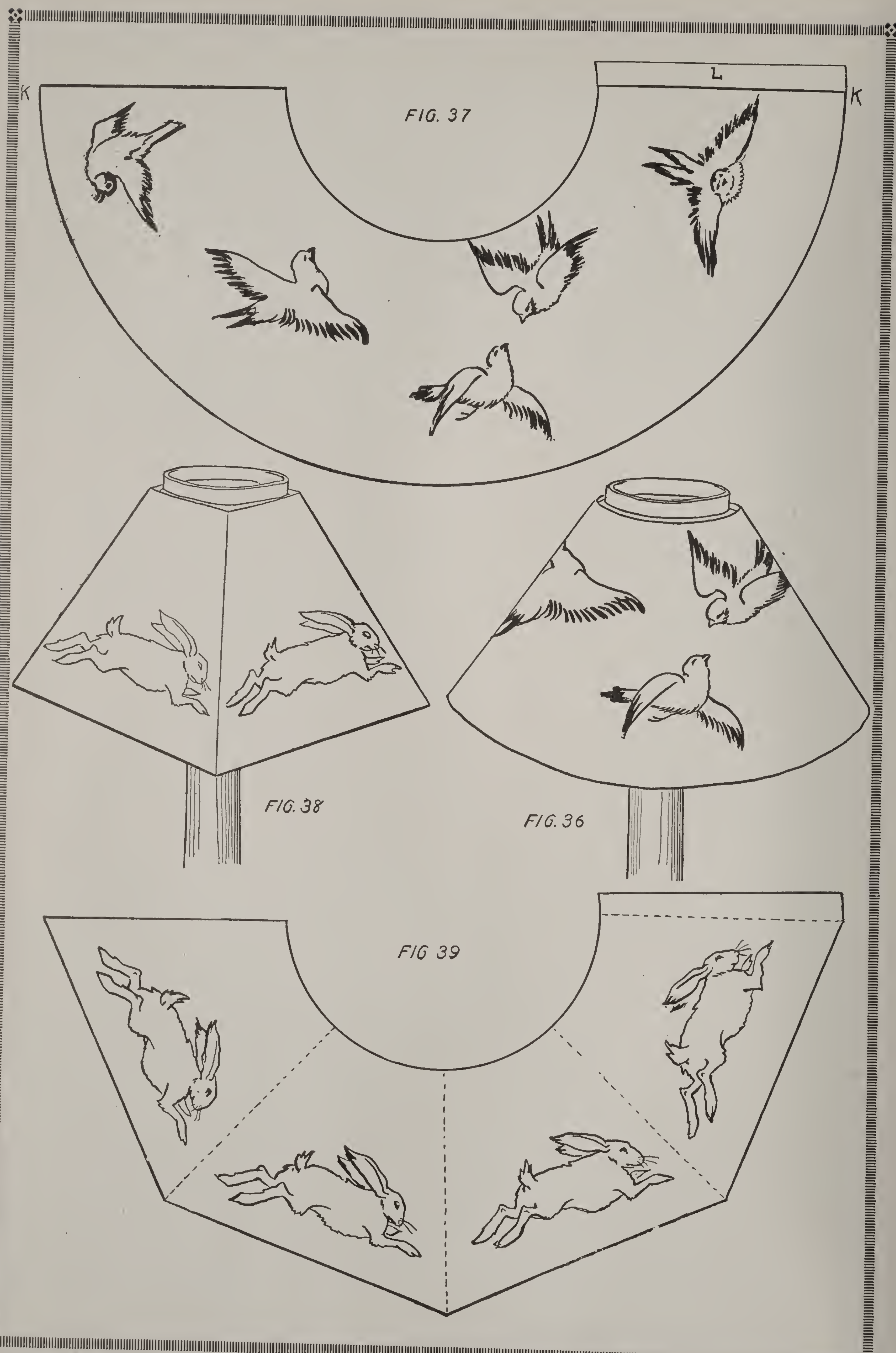


FIG. 37

FIG. 38

FIG. 36

FIG 39

ground; Fig. 39 gives the pattern with dotted lines indicating where to bend the paper.

All of the designs here given are attractive when used as dinner or dance favors, Christmas, birthday, New Year's or Easter gifts and also as decorations.

Queen Mab

A little fairy comes at night;
Her eyes are blue, her hair is brown,
With silver spots upon her wings,
And from the moon she flutters down.

She has a little silver wand,
And when a good child goes to bed,
She waves her wand from right to left,
And makes a circle round its head.

And then it dreams of pleasant things—
Of fountains filled with fairy fish,
And trees that bear delicious fruit,
And bow their branches at a wish;

Of arbors filled with dainty scents
From lovely flowers that never fade,
Bright flies that glitter in the sun,
And glow-worms shining in the shade;

And talking birds with gifted tongues
For singing songs and telling tales,
And pretty dwarfs to show the way
Through fairy hills and fairy dales.

THOMAS HOOD

How to Make and Use Stencils and Wood Print Blocks

I AM stenciling a border design of a pink flower between two tender green leaves on a white dotted swiss bureau scarf. My pincushion cover is finished and greatly admired by my sister. The scarf will soon be done—it is a very dainty, pretty scarf and I am doing every bit of the work myself. I even made the manila paper stencil, Fig. 1—but that was almost as easy as the actual painting of the colored stencil on the bureau scarf.

You can almost hear the little worker say this, as you see her in the photograph seated by the side of her sister, while carefully yet vigorously plying her brush.

Stenciling is really very simple work, it is merely scrubbing over holes in a piece of paper with a brush covered with paint or dye. Of course, cloth is under the paper, so the brush rubs color on the cloth beneath

FIG. 1

the open holes, and when you take away the paper, lo! the cloth is beautifully decorated.

We will choose for our first design one with simple lines easy to make, like Fig. 2. This cloverleaf motif will need but one color, a soft green, not too dark, rather light in tone. It is always best for a beginner to use only one color on the first design, but after learning how to handle the work, many colors may be used in different parts of one pattern. Regular stenciling

FIG 2

colors come especially for the work, but tube oil paints or diamonds dyes give excellent results. The little stenciler in the picture is using cold

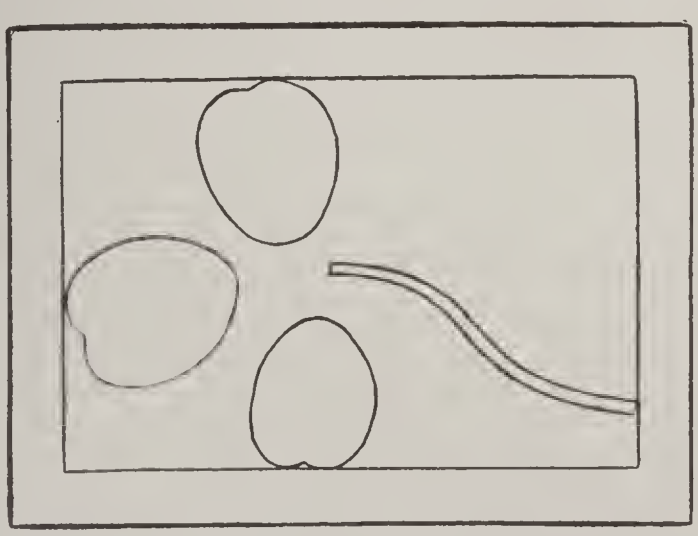


FIG. 4

water dyes, which come in tubes and are dissolved in water. The most popular kind of colors, however, are tube oil paints diluted with turpentine until completely dissolved, and the paint is more like a stain than paint.

Always prepare sufficient paint or dye at one time for the entire work, as it is most difficult to match the first tint or shade in a second mixing. When more than one color is used, have a separate brush and a separate cup for each.

Now let us make the stencil. Cut a piece of your smooth, heavy manila wrapping paper, 6¼ in. long and 4¾ in. wide, measure ½ in. from each of the four side edges and

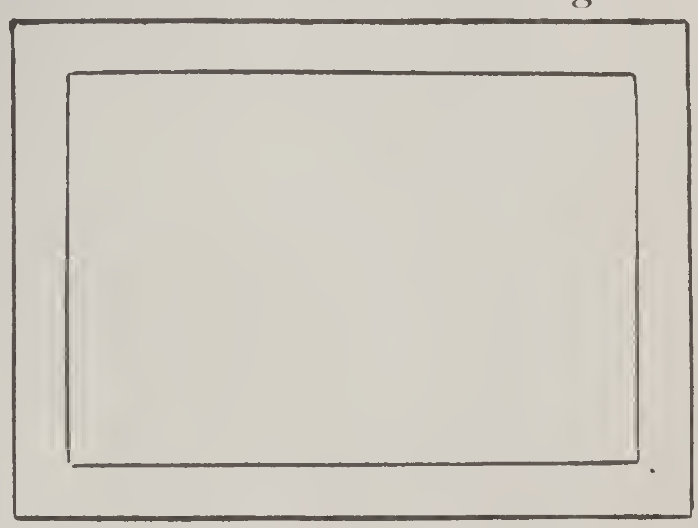


FIG. 3

draw light pencil lines across from side to side, forming a ½ in. wide frame, Fig. 3. Notice where each of the three leaves and end of stem

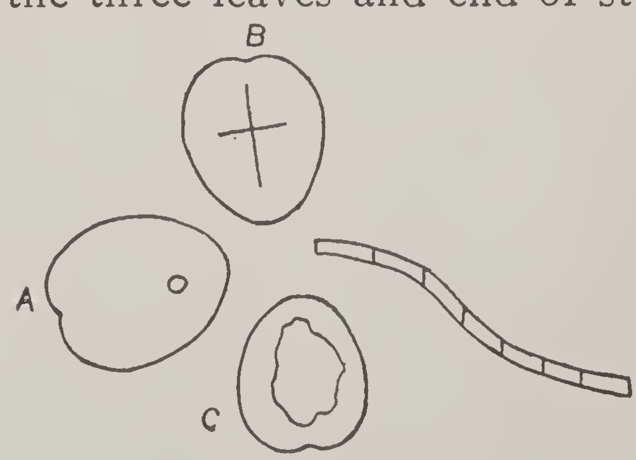


FIG. 5

touch the boundary lines on Fig. 4. Use Fig. 4 as a guide and draw in your cloverleaf pattern.

Have sharp scissors for cutting out the design, begin by running the

How to Repeat a Design

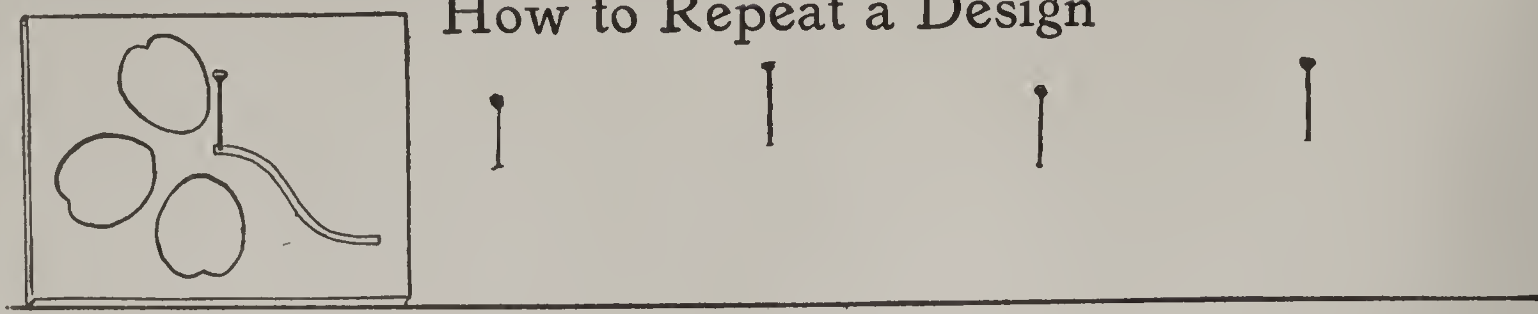


FIG. 6

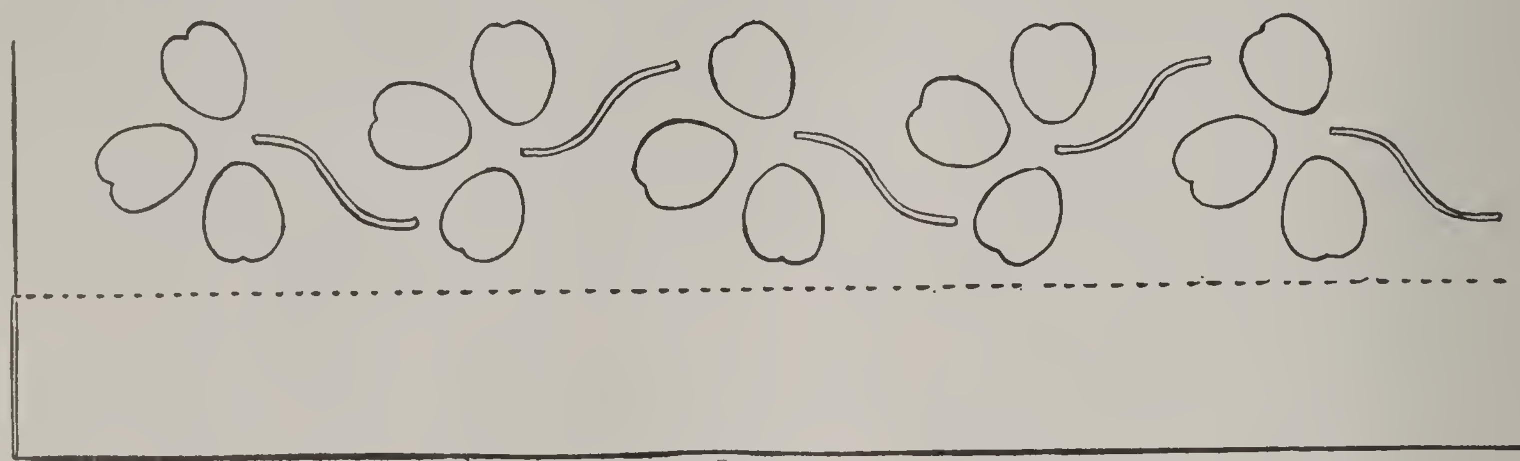


FIG 7

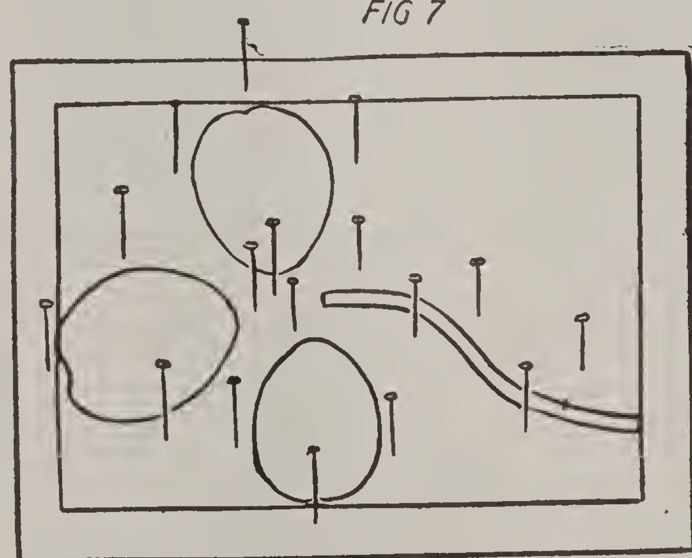


FIG. 8

point of one blade of the scissors through the lower space of one of the leaves, Fig. 5, dot on leaf A. Cut toward top of leaf; then across as in leaf B. Cut off the slashes and make a large opening, leaf C, which gives space to use the scissors carefully to cut evenly and smoothly along the line of the design. Be cautious while cutting out the stem not to clip beyond the lines, because such a clip will let the paint come through on the cloth at the wrong place and spoil the stencil work. Cut little by little in short sections, as shown by cross lines on stem, Fig. 5. When the entire clover leaf and stem have been cut out away from the paper leaving three even, smooth edged holes where the leaves were and one long narrow, smooth edged hole where the stem was, the paper will be a stencil.

Place this stencil down flat on a smooth board and give it a coat of white shellac, then raise it carefully, place it on another part of the board to dry. As soon as the stencil is perfectly dry, varnish the other side and all the edges; do not forget the edges, they are very important. Shellac stiffens the paper and makes the stencil durable and waterproof.

When the stencil is absolutely dry on edges and both sides it is ready to use, and you can begin decorating your sash curtains of fine cream colored cheesecloth. First hem top and bottom edges, then lay a large sheet of white blotting paper over the table or lapboard on which you intend to work. Over the blotting paper place the cheesecloth right side up. Have it perfectly smooth, and try measuring with the stencil to find how often the pattern can be used across the bottom of the cur-

FIG 9

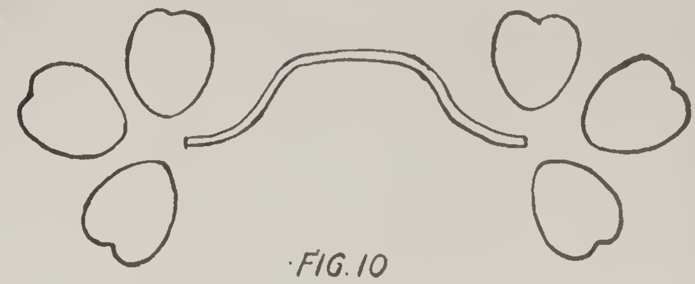


FIG. 10

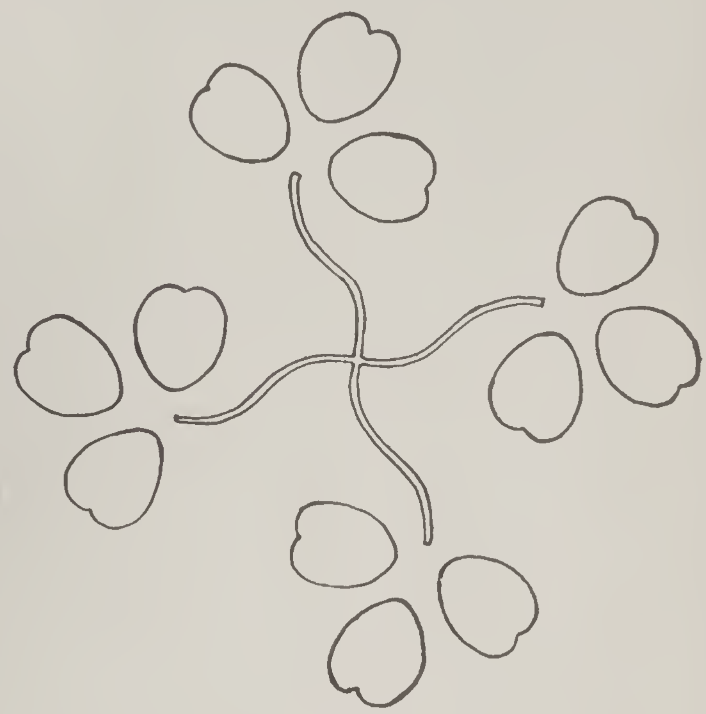


FIG. 11

tain, leaving the same sized space between each print. Having ascertained this, drive a pin where the center of each repeat should come, Fig. 6. In this example the stencil is turned and turned again in order to bring the stencil up in every alternate cloverleaf, Fig. 7. When ready to begin stenciling, make sure that the paper stencil lies absolutely flat down on the cheesecloth. You will want the decoration in a straight line over the bottom hem, so place the stencil just above the hem and secure it by driving in a pin at top and bottom and on each side of each leaf, and at intervals on both sides of the stem. Wherever the stencil seems to rise, flatten it down with a pin, Fig. 8.

Have within easy reach your prepared color, a stiff, short, stub, bristle brush and a piece of old white muslin—then commence work. Dip the brush in the paint and immediately rub it on the old muslin to remove most of the moisture. If the brush is too wet, it will blur the outline of your work. Be sure to wipe it on the muslin after each dip.

Holding your brush firmly straight up and down, not slanting, begin at the left hand and scrub each opening until the cloth is of the right tint and the paint has penetrated entirely through the cheesecloth; then take out the pins, lift the stencil, and adjust it over the next pin which marks the spot where the pattern should come. Continue in this way until the border is finished.

Fig. 9 gives the finished curtains with polka dots stenciled over the entire curtain above the border at uneven distances. You can make a polka dot stencil and use it on your curtain. Cut a perfectly round hole in a piece of paper, prepare it for use as a stencil and make the dots as in Fig. 9. This clover motif can be

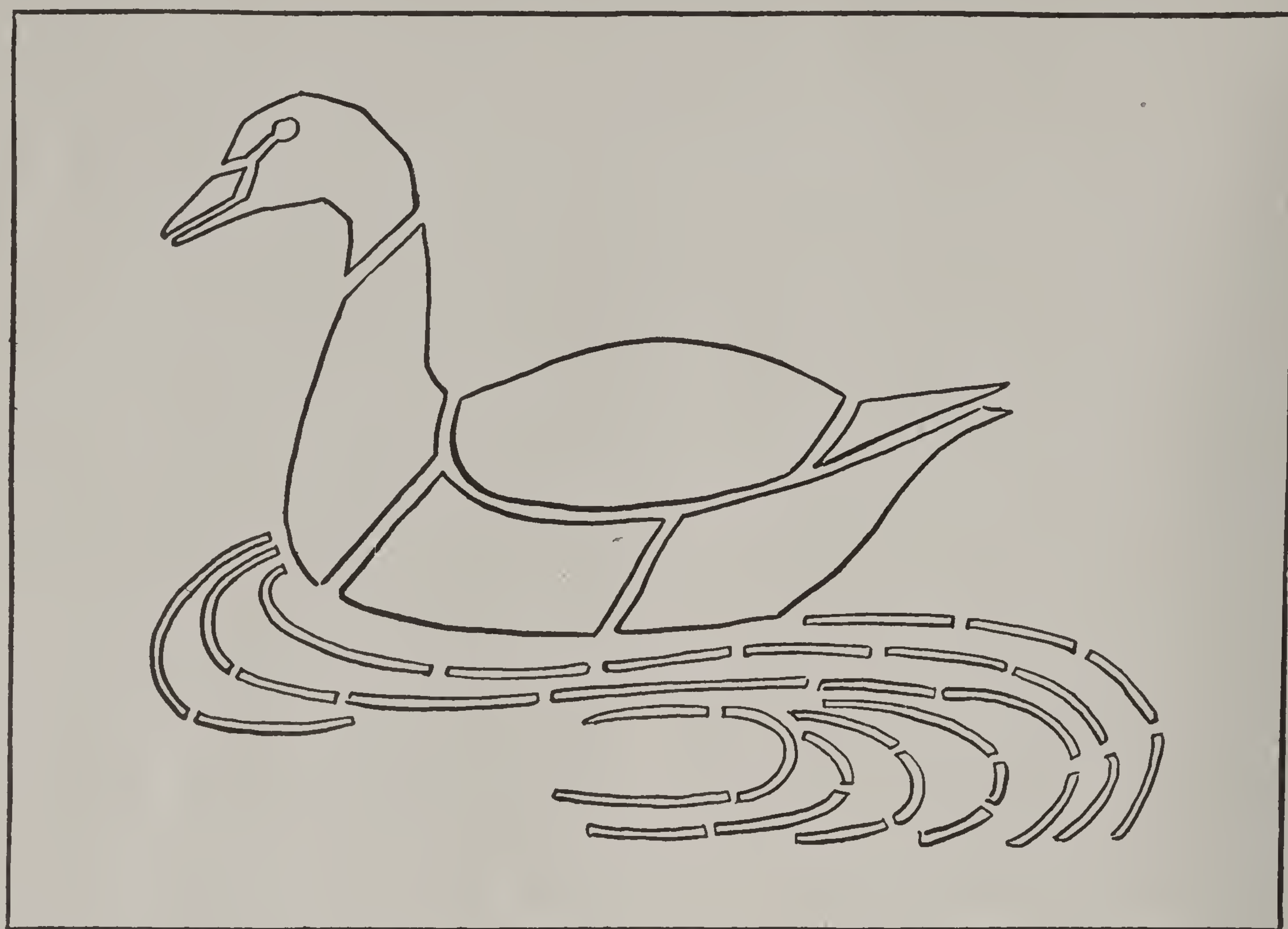


FIG. 12

FIG. 13

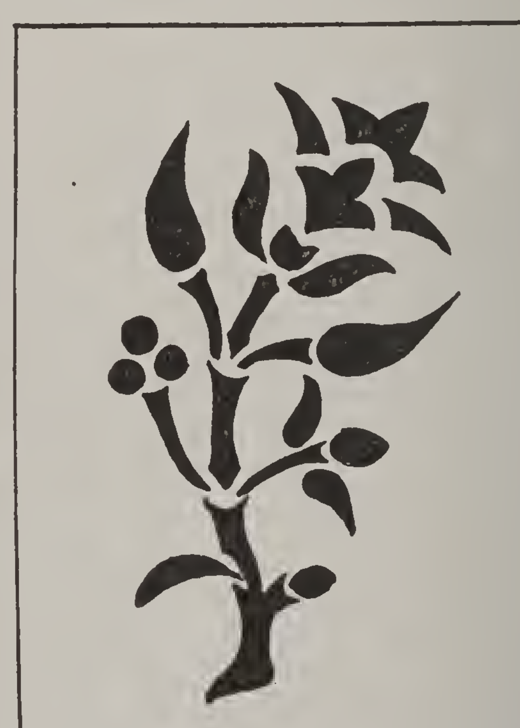


FIG. 14

FIG. 15

reversed, Fig. 10, grouped Fig. 11, used for an all over decoration alone or grouped, and it may simply be repeated without turning, making the stems all stand down.

The duck swimming on the water, Fig. 12, is fine for the playroom wall poster, toy chest, etc. It is a stencil invented by the writer especially for you. Try it. Here is another idea. On a heavy wooden plate, stencil the pussy pattern, Fig. 13. This pussy can also be used on the lid of a round box and other things. Fig. 14 is more difficult and is for you to try after having stenciled easier patterns.

FIG. 16

Remember, when making stencils, to always have little bridges or bands of the background reach across openings in the pattern to connect the different parts of the background together. Notice Fig. 15 is divided into many parts by the little bridges which are marked with the letter "O" that you may distinguish them from the design proper. There are ten bridges—count them—in common with the other stencil patterns. This also was worked out for you, so be sure to use it.

Stenciling may be made on almost any kind of material, except metal and rough surfaces. Wooden boxes, parasols, lamp shades, paper, linen frames, portieres, walls, splint-baskets, curtains, dresses, bags, bedspreads, lunch sets, tablecovers; and on the following weaves, monkscloth, swiss, pongee, denim, scrim, cheesecloth, linen, unbleached muslin, silk and muslin, but not on velvet or plush.

Block Printing

No bridges are necessary for this work and you use wooden blocks to print with instead of a paper stencil. Find a very simple pattern, trace it on the level, smooth side of a soft pine block, 1½ in. thick and sufficiently large for the pattern. Rub a lead pencil lightly over the entire design, taking great care not to mark the background. This lead pencil tinting will separate the pattern from the background so you will know which is which. With a sharp knife cut down into the surrounding background, following the outline of the pattern most carefully, bevel the edge as you cut, then cut another line close to the first and in this way make a narrow wedge-shaped trench ⅛ in. deep entirely around the pattern, after which you can cut away the background little

A "Beetle" Block

FIG. 17

by little, causing the design to stand out well above the background. The aim being to have the pattern ⅛ in. higher than the background, much in the same way as the letters of a rubber stamp stand up higher than the stamp itself, Fig. 16.

Your color pad will be something like a rubber stamp pad, and larger than your printing block. As a foundation use a piece of wood about ½ in. thick. Cover one side with tightly pressed down raw cotton. Glue it on the board and over the cotton glue a piece of smooth level tin. On top of the tin glue two layers of felt, cover all with a piece of muslin, bring it down over the four sides and glue it on the bottom of the foundation. The top surface of the pad must be absolutely smooth.

Either oil paint or water colors may be used. Dilute water colors with water slightly thickened with dissolved gum arabic, but only sufficiently so to cause the water to feel a little sticky.

The oil paint can be diluted with turpentine, which should be added gradually, constantly testing the color on a piece of cloth. As soon as the diluted paint is of the right shade, spread it on your pad with a flat bristle paint brush; dip the brush in the paint and sweep it back and forth over the pad, until the pad is well soaked, but not sloppy.

Press the block on the pad and test a print on a piece of testing cloth taken from the material you are to decorate. If the block is of good size, hold it steady on the cloth and strike it once with a hammer. Unless the blow is sharp and quick the print will not be clear.

For a Rug Border

FIG. 18

Probably you will have to experiment, making a number of prints before obtaining a satisfactory one. As soon as your block prints a clear, perfect design, begin work on your rug, curtain or whatever you have selected for decoration, but before printing, place the cloth on a slightly springy surface. Several layers of smoothly folded newspapers will do nicely.

When more than one color is needed there must be a separate block and a separate color pad for each color.

Fig. 17 is a simplified beetle print block design. A good design for the border of a solid colored ingrain, or other smooth surface rug is the original design, Fig. 18, made by cutting a folded piece of paper. You can make charming patterns in this way. Simply fold a square piece of paper and cut out portions of it. Open the paper and your design will be made. With a little practice you will catch the idea and be able to make an endless variety of very beautiful designs.

Fig. 19 gives a border of little fluffy chicks printed with one block on which is a design of one chick. The camel, Fig. 20, is a pattern for block printing, also Fig. 21, the little seahorse and Fig. 22, the elephant.

Block printing may be applied on curtains, tablecovers, sofa pillows, bags, bed covers, sash curtains, portieres, screens, rugs, couch covers, straw matting, etc., and on most woven materials. Always experiment on a waste piece of the material you intend decorating to make sure the print will work satisfactorily.

Baby Chicken Block Border

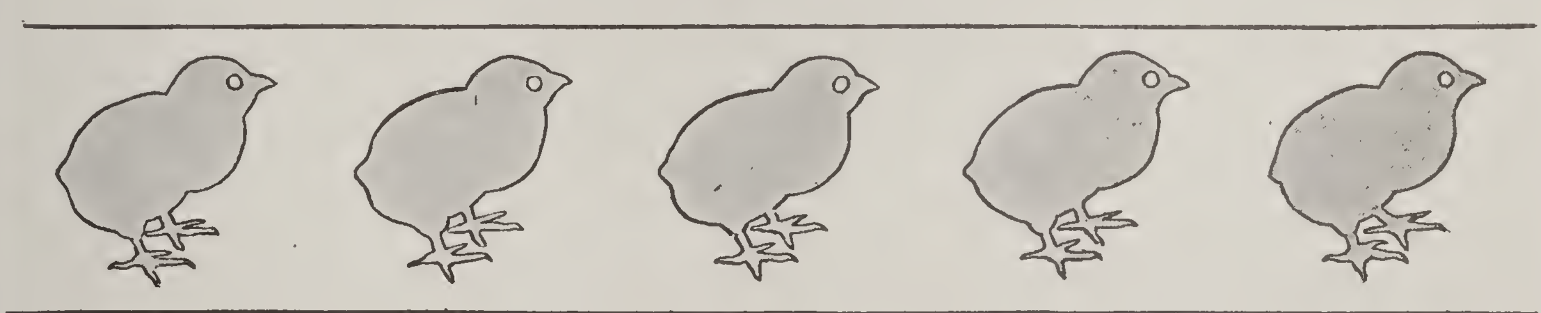


FIG. 19

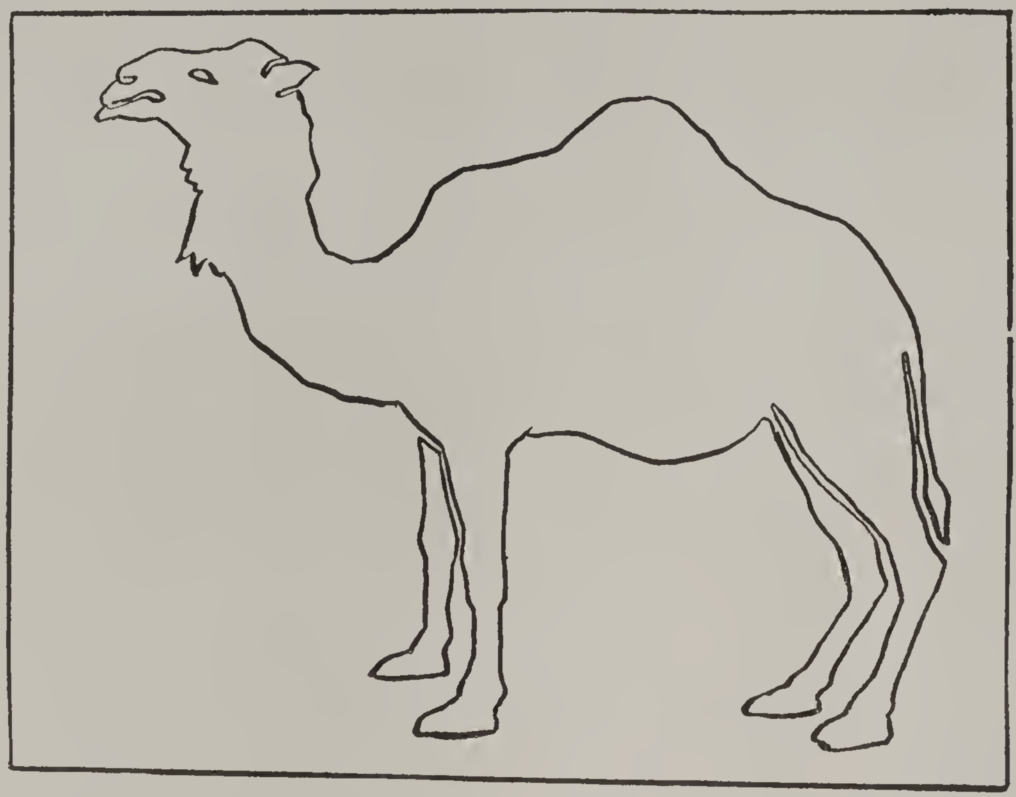


FIG 20

FIG. 21

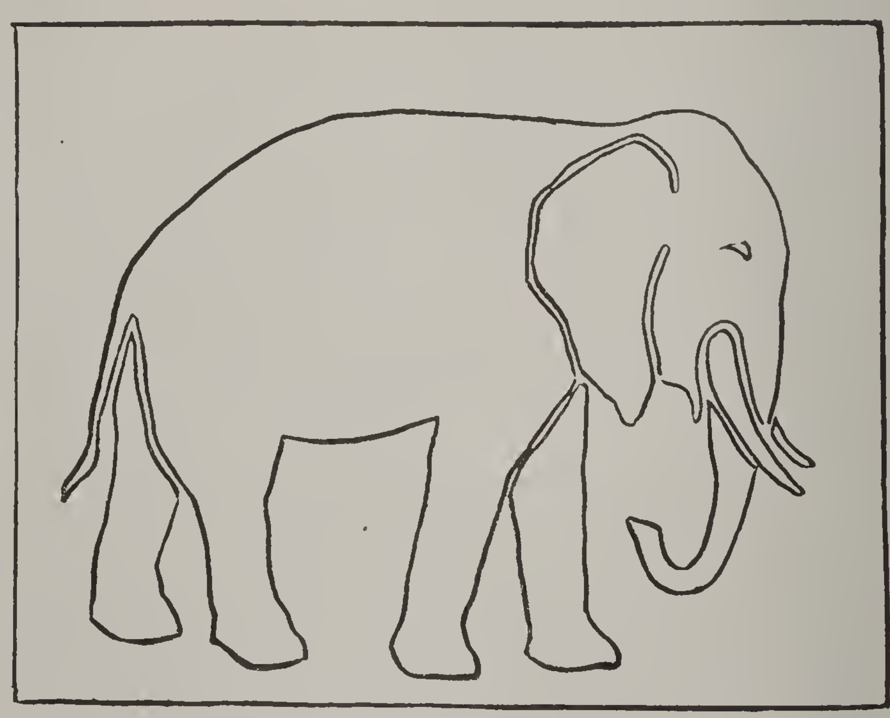


FIG. 22

What Food Does For Us
and
What We Must Do To Food

"Tidying Up" After a Meal
"A clean kitchen is an absolute essential. Everything in the kitchen should be washable and kept clean as soap and water and scrubbing can make it. Dirty dishcloths and towels are nothing less than an abomination."

YOU have eaten three meals a day most of your life, but can you tell what food is and what it does?

Food gives us the material for building our bodies. It is also like the fuel in an engine, for it supplies the warmth of our bodies and gives them the power to work. When the engine wears out it must be sent to the repair shop, but our bodies are daily being repaired by the food we eat.

What Food Really Is

Does it surprise you to know that the many kinds of food that you eat throughout the year—meats and fish, eggs, milk, vegetables, fruits and grains—are all made up of a very few substances? These materials are called *food stuffs*. The food stuffs found in milk are water, fat, sugar and mineral matter, and a substance called protein found in the curd. Protein is a substance that oc-

curs in the curd of milk, in eggs, in the lean of meat, in fish, in nuts, in the seeds of plants like the grains, and in peas and beans. It contains nitrogen, an element which is found in all living tissues. Although nitrogen is in the air around us and we draw it in with every breath, we breathe it all out again, and use it only in the form of protein, which will build the body and give energy.

Fat gives the body energy and is sometimes called a fuel food. Fat is a substance with which we are familiar. It is found in butter, lard, cream, in the fat of meat, in olive and other vegetable oils. The fat of meat and cottonseed oil are the cheaper fats.

Sugar and starch are two other substances that you easily recognize. These two materials, that look so different from each other, are really very much alike and Mother Nature can turn one into the other. This is what happens in our bodies, for starch is changed into sugar before it is taken into the blood. These two food stuffs are called carbohydrates. Another carbohydrate is the fibre of our vegetable foods known as cellulose. We do not digest this, but it gives bulk and in this way helps digestion. Starch and sugar are fuel foods, too, and they are the cheapest fuel foods.

Water does not seem to you like a food stuff, perhaps. It does help to build the body, but it does not give us energy.

Mineral matter or ash you cannot see in your food but if you burn any food material long enough there is an ash left behind like the ash from wood or coal. The substances found in the ash of food, are lime, potassium, iron, sulphur and so on. These mineral substances help in body building, but do not give energy. The foods that give us energy do so through a slow burning process. Water and ash cannot give energy, because they are themselves the products of combustion.

Table for Selection of Foods

Here is a table that will help you to select foods:

Example of food materials rich in each of the food stuffs.

Proteins:
- Eggs
- Milk
- Cheese
- Lean meats
- Fish

Fats:
- Cream
- Butter
- Meat fats
- Vegetable oils
- Nuts
- Yolk of egg

Carbohydrates:
- Cereals and cereal products
- Potatoes and other starchy vegetables
- Chestnuts
- Sweet fruits
- Sugar

Mineral Matter:
- Milk
- Green vegetables
- Fruits
- Whole wheat and other whole cereal products
- Egg yolk

Water:
- Fresh fruits
- Fresh vegetables
- Milk
- Beverages, including water as such

The Uses of Water

Water helps to build the body, to dissolve food, to carry off waste and to keep the temperature of the body even. About two-thirds of the weight of the body is water. Drink it freely every day and use it at meals, even as much as a pint, but swallow it when the mouth is empty. When you have soup, milk or beverages, drink less water at a meal. Water must be clean. It should come from a source where no filth can contaminate it. Sometimes it is necessary to boil water at least half an hour, and cool it before drinking, in order to destroy the germs of disease that are present.

Use clean vessels for drinking. Two people should never drink from the same cup. The use of paper cups, or the drinking fountain that needs no cup, is very important. Ice must be watched as carefully as water, for freezing does not destroy germs of disease. It is better to cool water on ice than to put ice into the water.

Caution About Use of Ice

Food Value of Milk

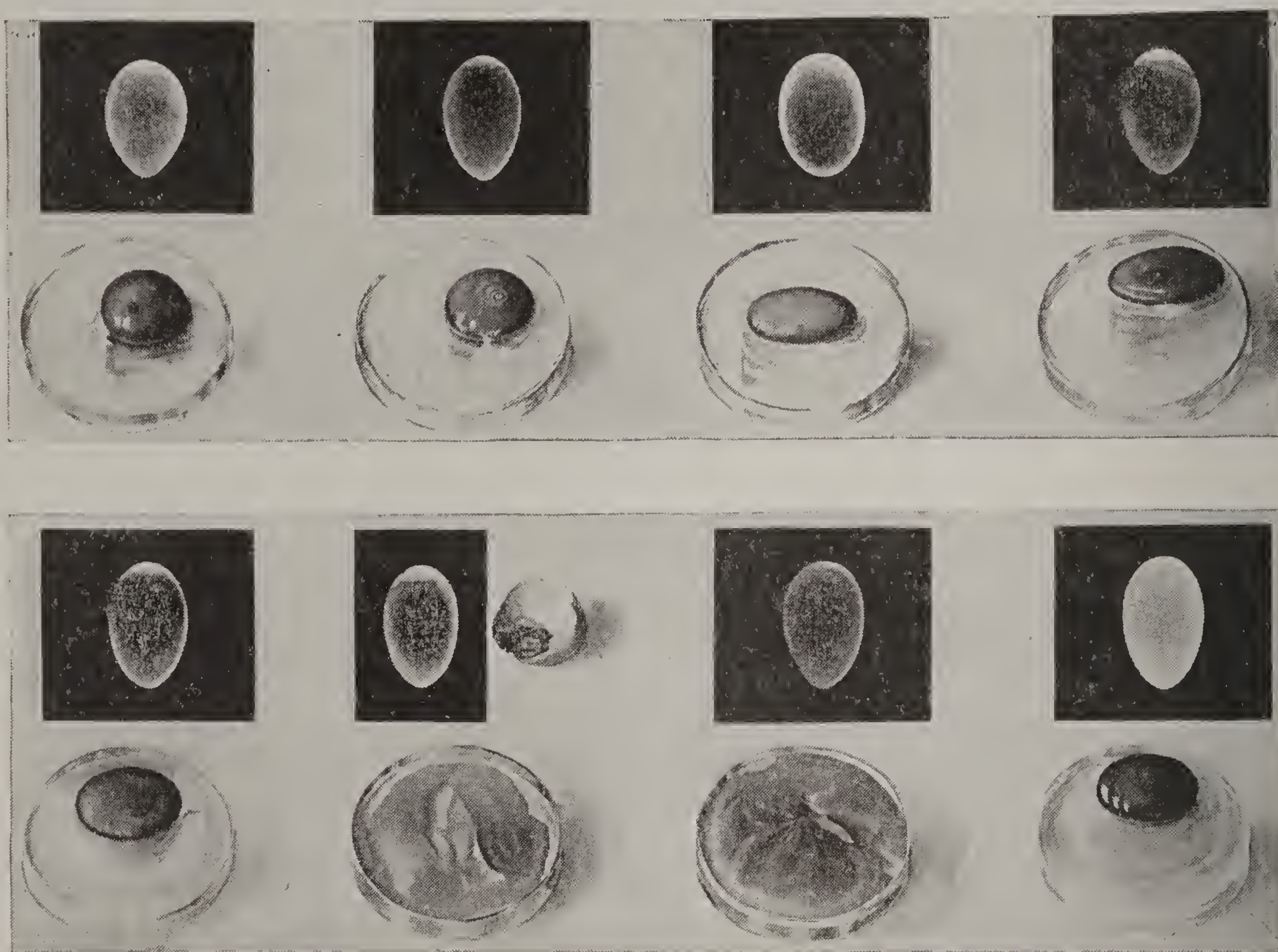
Milk is an important food. Milk is a perfectly balanced food for the baby and young animals who have nothing else to depend upon. It is a desirable food for grown people. Remember that it is food and not drink only. If you think milk does not agree with you it may be that you take it as a beverage in addition to quite enough of other foods.

Milk must be clean, for typhoid fever and other diseases are carried in dirty milk. The cow must be in

A Class of Little Cooks

Domestic Science is usually a popular study with girls. It is a part of the movement to teach children who leave school at their fourteenth year something which will really be of use to them in their future life, instead of simply preparing them for high school and college which they may never reach. This class is too large for all to be busy at once, so a few are chosen to demonstrate how the dish is prepared and another writes the recipe on the board, to be copied in notebooks and kept.

How to Test Eggs



The best way to tell whether eggs are fresh or not is to hold them before a lighted candle in a dark room. This chart will help you. It shows how the egg looked when held before the candle and also after it was broken in a dish. Reading from left to right:

1—A fresh egg. 2—Slightly stale egg showing evidence of incubation. 3—Stale egg showing a settled, flattened yolk and a thin white. 4—Egg with yolk beginning to adhere to shell. 5—Egg showing "blood ring." 6—Cracked egg invaded by mold and the shell showing mold inside. 7—White rot or addled egg. 8—Egg with a green white.

good health and kept clean. The stable, milker, all the utensils, must be absolutely clean. Milk must be cooled rapidly after milking and kept cool.

If you have no ice for cooling milk at home, scald it to kill possible germs of disease and the bacteria that sour it.

The digestibility of milk is not especially affected by cooking.

One quart of milk equals in food value one pound of steak or eight eggs. At ten cents a quart it is an economical food.

Cheese is manufactured from the curd of milk and has in it the most nutritive parts of the milk. It is a good meat substitute.

Skim milk is valuable for cooking and contains everything in the milk but the fat.

Sour milk is also useful in cooking.

Value of Eggs

Eggs contain all the food stuffs. If you have seen a young chick come from the shell you must realize that his little body has been nourished and built by the materials in the egg with something from the shell, and that he is strong enough to pick up his next meal.

The food stuff in eggs are in such

form that they are easily digested and absorbed. They are very valuable for little children, for people who are below weight, and for invalids recovering from an illness.

Fresh eggs are not always easy to obtain. Find out if in your state there is a law to protect you from buying cold storage eggs for fresh. Perhaps you can buy them "parcel post" direct from some farm.

In cooking eggs, if you wish a delicate, jelly-like egg cook it below the boiling point of water.

A hard cooked egg takes longer to digest than a raw or soft cooked egg, but if chopped fine and properly masticated it is digestible and a very convenient dish to serve. If you prefer a soft egg that is yet somewhat firm, cook it in boiling water for four minutes.

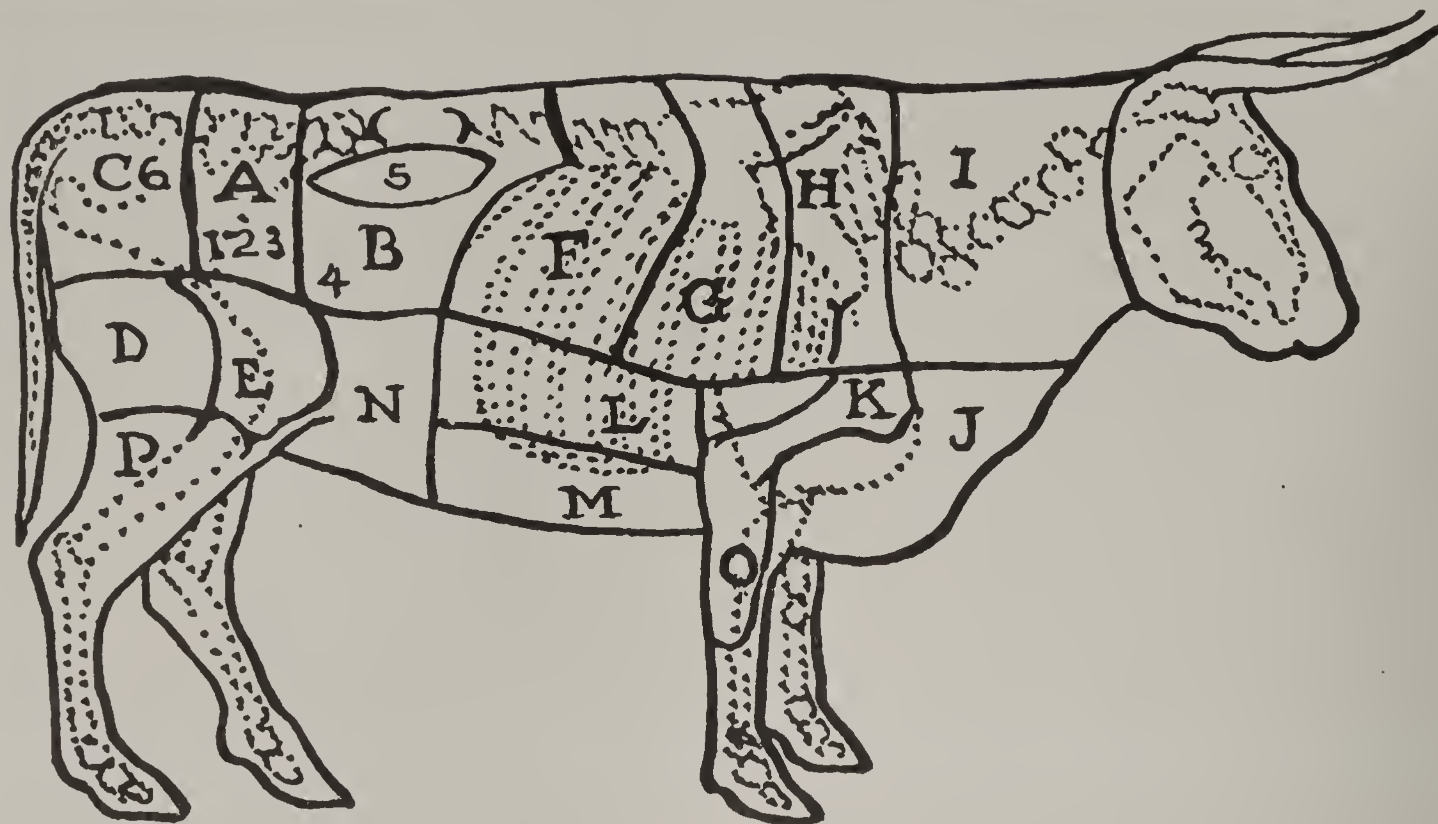
What Shall We Do About Meat and Poultry?

Meat has become such an expensive food that we want to do without it if possible. We do not need it more than once a day, and people can keep well and strong without it. If you are in the habit of eating meat often, make the change from meat to other foods rather slowly. The meat substitutes are the other foods that contain protein.

Tough and tender meat vary little in nutritive value except that tough

A Visit to the Meat Market

Here is a high school class in Domestic Science learning about meat at first hand. See how industriously they are taking notes on what the butcher has to say.



The Different Cuts of Meat and What They Are Used For

A. Sirloin
  1—Round bone sirloin, poorest sirloin
  2—Flat bone sirloin, next best sirloin
  3—Hip bone sirloin, best sirloin steak
B. Porterhouse
  4—Club steak
  5—Tenderloin
C. Rump
  6—Corning, best corning piece
D. Round
  Used for steaks and pot roasts
E. Top sirloin
  Used for steaks and pot roasts

F. First prime ribs
  Good Roasts
G. Second cut ribs
  Good roasts
H. Chuck ribs—poorer roasts and steaks
I. Neck—for beef tea, stews and boiling
J. Brisket—corning
K. Cross rib—pot roast
L. Plate—corning
M. Navel—corning
N. Flank—stew or boiling
O. Shoulder—soup
P. Shin—soup

meat contains somewhat more material than the tender.

Tough meat comes from the parts of the animal's body that are most exercised, and tender meat comes from the less. Tough meat is cheaper because it is less in demand.

If meat is taken in excess, too much acid is formed in the body, and people who eat meat must be careful to take fruit and green vegetables and plenty of water. Meat spoils easily and may contain bacteria that gives us disease. State

Dangers From Meat

and city inspection of meat and clean markets should protect the consumer from this cause of meat poisoning. Parasites like the tapeworm come from meat and these are destroyed by thorough cooking. The housekeeper must be careful to cool off cooked meat and broths rapidly, for in tepid mediums bacteria may develop. This is very important.

In cooking tender meat the outside surfaces are seared by intense heat, and the inner part cooked at a lower temperature. These processes are broiling, boiling, and roasting. In cooking tough meat we must use a lower temperature for a long time to soften the tough fibre. The processes are stewing, braising, and pot roasting.

In soup making and in beef tea the juices of the meat should be extracted by cold water which is slowly heated afterward.

Over-cooked meat has a shrunken and hard fibre. Do not fry tender meat in fat, but use only enough fat to keep the meat from sticking to the pan. The tenderest meat cooked

How Meat Should Look

By studying the diagram of the steer divided into the different cuts, and comparing it with the pictures of the cuts on this and the next page, you can learn to know what you are buying and whether it is what you want or not.

At the top are two pieces of round steak, (1) and (D) on the diagram. Below are the two best sirloins, (2) and (3) on the diagram. Compare the shape of the round and sirloin cuts with that of the Porterhouse on the opposite page. If you know how these cuts look, a dishonest butcher will never sell you a sirloin for a Porterhouse and charge you accordingly. At the bottom are the best rib roasts in the animal.

Chops and Steaks

In the top row are four different kinds of lamb chops, taken from different parts of the animal, and three of the lower grades of steaks. The next two are roasts. The chuck rib roast is not so good as the blade rib roast on the right, which is taken from the vicinity of the seventh and eighth ribs. Notice how the meat is streaked with fat in the better roast. The last row on the page shows the two best cuts of steak.

hard in fat is but little more digestible than sole leather.

In buying meats select that which is firm and with a good red or pink color, and poultry that is firm, with fat under the skin. Poultry that has

a dull colored, broken skin may have been in cold storage too long.

Cereal Products

Breakfast foods made from grains are a valuable part of the diet and are manufactured from oats, wheat, rice, corn, and sometimes barley and rye.

In cooking cereals, we need to soften the fibre of the grain, and thus make the other food stuffs easier for the body to assimilate. The starch grains are opened by the heat.

How to Cook Cereals

Flaked cereals need at least two parts of water to one of cereal. Granular cereals need three to four times as much water as cereal. Cracked wheat, coarse corn meal and samp need from four to six parts of water. One cup of dry cereal is enough for three or four people. A tablespoonful of salt to a quart of water is a good amount. The water must be boiling and the cereal dropped in so slowly that the water does not stop boiling. When the cereal is thickened, cook it in a double boiler an hour or more.

Cold cereals should not be wasted. They can be molded in small cups with fruit cut in slices and made into small cakes mixed with beaten egg. They may also be used in muffins, yeast bread, and for thickening soup.

How to Make Good Bread

Yeast bread, made of good white flour, is so extensively used that it may still be called the staff of life. The flour should be creamy in color and granular to the touch. A good mixture for bread is a combination of flour made from spring wheat, which is planted in the spring and matures in the summer, and winter wheat growing farther south and living through the winter.

Why Loaves Should Not Be Too Large

The loaf should not be too large. This gives a good crust and the loaf is easily baked to the center. The crumb of the bread should be creamy and not snow white, and when it is pressed between the fingers it should be tender and elastic. The crust should be even in color,—a golden brown—and it should be crisp and soft, but not hard and tough. Here is one score card used in judging bread:

Bread Score Card

I. General Appearance		15%
1. Shape	2.5%	
2. Size	2.5%	
3. Crust	10.0%	
(a) Color.		
(b) Smoothness.		
II. Internal Appearance		55%
1. Depth of crust	10%	
2. Texture (lightness)	15%	
3. Crumb	30%	
(a) Moisture		
(b) Elasticity	25%	
(c) Color	5%	
III. Flavor		30%
		100%

Bread is a cheap food compared with other foods.

In making bread at home the necessary materials are flour, yeast and liquid. You may add salt to give flavor, a little sugar, and sometimes fat to make the crust more tender. Nuts and raisins make a pleasant variety, added to white or whole wheat flour bread.

Yeast is a tiny, one-celled plant. In preserving fruit and vegetables

we destroy it, but in making bread we cultivate it. The bread mixture gives it food and moisture, and if we warm the materials and keep the dough at a temperature from seventy to eighty degrees, the yeast will bud and increase. As the yeast cells multiply they form a gas, which expands and makes the whole mixture light. A little alcohol is also formed, but the gas and alcohol pass off in baking.

How Yeast Makes Bread Rise

The proportions used in making bread are one portion of water to three of flour, which makes a loaf of good size. The liquid may be half milk and half water, in which case the milk should be scalded first and cooled to the proper temperature by adding the water cold. The larger the amount of yeast used the quicker the process of rising—from one fourth to half a yeast cake to a loaf is allowable. All the materials should be warmed, thoroughly mixed, set in a covered bowl until the mass doubles its bulk. The dough must be kneaded by hand, or better by machine until it is smooth and elastic. It then can be divided, put into greased pans and left to rise again to double its bulk, when it is ready for baking. Kneading makes a fine grain, and some people knead the bread twice before it is put into the pans. The bread should be baked at a steady temperature of about 380° F., from three-fourths of an hour to an hour. This is what is called a moderate oven.

The care of bread after baking is important. It should be cooled before putting away and not eaten for twelve hours. Keep it in a stone jar or tin box, which should be scalded

Serving the Meal

Not only should girls learn to proportion and cook food properly, but they should know how to serve it daintily and well. The teacher is pouring coffee, three of the class are guests and two are serving the meal.

with boiling water before new bread is put in. The bread may be covered with clean paper to keep it from drying.

Stale bread may be used for toast, bread crumbs, scalloped dishes, and puddings. All pieces should be saved for these purposes.

Mixtures of flour with milk or water, salt, sometimes eggs and baking powder, are called quick breads—muffins, pop-overs, and so on.

Use of Quick Breads

They are convenient and make an agreeable change, but they do not take the place of yeast breads.

Baking powder is made of some acid substance like cream of tartar mixed with bicarbonate of soda, and when these are combined with the liquid and heated, a gas is given off. The proportion of cream of tartar and soda is two to one. Sour milk and bicarbonate of soda also give off the gas. A level teaspoonful of soda to a cup of sour milk is about the right proportion. Acid molasses and soda behave in the same way, but the modern canned molasses contains no acid and baking powder must be used with it. In buying baking powder avoid the kinds that offer prizes. They may contain an inferior kind of acid and a large amount of starch or flour, only a little of which is necessary in any baking powder. A standard kind from a well known firm is the most economical in the end.

Looking Over Berries

Girls who have taken Domestic Science at school during the winter sometimes have ideas of their own about the way in which the summer supply of fruit should be canned. They can sometimes give their mothers valuable little hints about cleanliness and economy. This girl is picking over strawberries for preserves.

Quick breads are more wholesome if reheated and not eaten just after they are taken from the oven. This is also convenient for the housekeeper who may bake them the day before and warm them over for breakfast. This makes the crust crisper and the crumb drier.

Breads Made of Cornmeal

We should use more cornmeal than we do in our quick bread, as it is a wholesome and economical material. The cornmeal ground in a modern mill needs rather more moisture and more fat than the old-time meal ground between stones. If you cook the cornmeal thoroughly before making the muffins you will find the flavor better, and the muffins less dry.

Fruit in the Diet

Fruit should be eaten daily, for it contains some of the most valuable mineral substances. In buying fruit select the least expensive, for the cheaper kinds are just as useful as those with the fancy prices. Apples are especially useful in the diet.

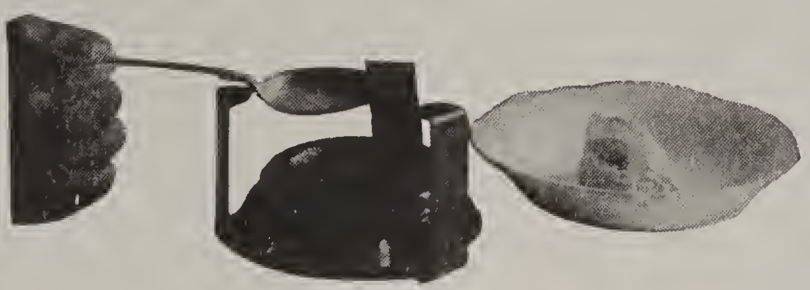
Cooked fruit is more digestible for many people than the uncooked and this is especially true of little children. Cooking softens the fibre and

destroys disease-breeding bacteria.

Canning and preserving processes are necessary, because they give us fruit and vegetables cheaply when they are out of season.

We preserve food by destroying bacteria, yeast and molds through the application of heat and by sealing the cooked food material thus keeping out these lower forms of life.

Is It Real Butter?



Genuine butter boils quickly. Adulterated or imitation butter melts, but is slow to boil.

Preservatives are materials in the food which prevent the growth of these little organisms. The old-fashioned preservatives are sugar, salt, smoke, spices, vinegar and even alcohol. A little sugar causes fermentation because it gives food to the tiny yeast cells but a larger amount prevents their growth. Nowadays chemical materials are often used, and when these prove hurtful we should be protected by pure food laws.

Drying also preserves food materials because the tiny living cells need moisture just as we do, and cannot live without it.

Food Stuffs Contained in Vegetables

Vegetables are a valuable food. This list shows you what food stuffs vegetables contain:

Seeds contain all the food stuffs high in protein.

Roots and tubers contain all the food stuffs low in protein and fat, high in starch or some form of sugar.

Rinds contain all the foodstuffs in small amounts. The mineral content are the chief value.

Of leaves and stems the mineral content is the chief value.

In cooking vegetables we need to save the valuable mineral matter. It is better to use the iron found in spinach than to take it in doses from a bottle of medicine. When we cook our vegetables in boiling salted water and throw the water away we sometimes lose the most valuable part of our vegetables.

Bake, steam and stew vegetables whenever you can because in this way no nutritive material is lost. Stewing is cooking in a small quantity of water, to be served with the vegetables, or thickened for sauce.

Boil vegetables when they are old and you wish to be rid of a rank flavor. When you boil potatoes boil them with the "jackets" on.

Time Table for Stewing and Boiling

(For stewing and boiling unless stated otherwise.)

Fifteen minutes.—Tender cabbage and sweet corn. These are usually cooked too long.

Thirty minutes. — Asparagus; peas; potatoes of medium size; summer squash; tomatoes.

Forty-five minutes.—Young beets and carrots; onions; young parsnips; medium potatoes, baked; sweet potatoes, boiled.

One hour.—String and shelled beans; cauliflower; oyster plant; winter squash, steamed or baked; young turnips.

Two hours.—Old carrots, beets and turnips.

Six or eight hours (or more.)—

Dried beans, lentils, and peas, baked in the oven, with water added.

Something About Meat Substitutes

We have already studied the use of milk and eggs instead of meat.

Fish is a wholesome and economical substitute for meat in most cases. It spoils rather easily, and people who do not live by the sea and who cannot have a supply of fish from lakes and rivers should be careful in buying fish.

In buying fish see that it has been kept on ice, notice that the flesh is firm and the eyes bright. Notice the odor also. If in cooking there is a strong, tainted smell coming from the fish, do not use it. Canned, salted, and smoked fish is easily obtained and is very useful as a change from meat. If the top of the can bulges at all, do not buy it. The old-fashioned boiled salt codfish dinner with potatoes and beets is a simple and palatable meal. Notice in cooking fish that the connective tissue dissolves very easily, and that the fish is apt to fall apart. When fish is boiled it should be wrapped in cloth.

Left over fish will make a palatable breakfast, luncheon or supper dish with bread crumbs, rice or mashed potatoes.

Nuts are a simple and wholesome meat substitute. If cooked they are digestible for some people who cannot eat them raw. In any case they should be thoroughly chewed. They may be used in salads, in sandwiches, put into bread and muffins chopped and mixed with stewed or raw fruit, or eaten with salt and with raisins for a dessert. It may be that some people consider them indigestible because they eat them between meals or when they have partaken of quite enough meat food of other varieties. Remember that they are very rich in protein and treat them as a part of the meal in place of meat and you will probably have no indigestion.

How to Judge Food

The can of plums is unsafe. It is probably partly decayed. Gas has formed as is shown by the partly blown out top of the can. Don't buy cans of food that look like this. They are dangerous.

The Use of Salads

Salads can be used on many occasions—for luncheon, dinner and supper. The salad made of crisp green vegetables, of cooked vegetables, of fruit, of cold meat, fish, and of nuts served with a simple dressing make a pleasant variety in our diet. When made from cooked vegetables and left-over meat and fish, they are economical. They are wholesome when used as an essential part of the meal, and not as an extra when there is enough of other kinds of food.

Green vegetables should be thoroughly washed, thoroughly dried and cooled until they are crisp. All other materials should be cut in small pieces and chilled before they

are mixed and served on the green vegetables. The salad dressing may be nothing more than an acid with salt and pepper and an oil like olive oil or corn oil. More elaborate dressings are made from an acid and oil mixed with egg either cooked or un-

"Doing Up" the Dishes

Part of the cooking lesson is to wash every dish used and to put it away in its place. The picture shows a class of older girls, each with her dish pan on one of the diminutive gas stoves.

cooked. Butter may be used instead of olive oil in the cooked dressing.

Beverages and Their Use

Cocoa and chocolate are food as well as drink as they contain more or less fat—the chocolate more than the cocoa.

Tea is an agreeable beverage that we probably shall not give up. It contains theine, the substance which keeps some people awake, and tannin which injures digestion. Do not boil tea, and never let it stand on the leaves more than three to five minutes. In this way the amount of tannin present will be lessened.

Coffee contains caffeine which has somewhat the same effect as the theine. It also contains the tannic acid, and it is considered better to use a drip coffee pot or a percolator than to boil the coffee.

Young people should avoid both tea and coffee, and grown people should not take them in excess. One cup of coffee for breakfast seems to have little effect on some people. We should all be better without them.

Cereal beverages made from roasted grain give a pleasant hot drink in the morning, and are recommended often as a substitute for the tea and coffee.

What Shall We Have for Dessert?

A dessert must also be looked upon as giving a part of the nourishment afforded by a meal. We give

this name "dessert" to whatever we serve after the meat or meat substitute and vegetable courses.

Light desserts of fruit alone or made into pudding with some starch or with gelatine, belong at the end of a meal where there has been a large supply of meat and vegetables.

Desserts containing more food stuffs belong at the end of a meal where there is little meat or meat food. There are desserts made from eggs and milk, milk puddings, suet puddings, and pies where the fat in the crust is an important food stuff.

Pies need not be abolished provided the crusts are light and thoroughly baked. They should not be eaten too often, certainly not three times a day, for then they take the place of more desirable food. Used once in awhile they are a useful food. People who eat soggy, underbaked pie crust probably will have digestive troubles. It is a good plan to use a top crust only. If you wish a bottom crust too, bake that first, having coated it over with a little beaten egg. A still better way is to bake a pie crust in small squares or diamonds entirely by itself, serving it with stewed fruit. Or, again, bake the crust thoroughly in small patty pans, and then put in the material which is to give flavor.

As to the Eating of Pies

Something About Buying Food

Visit the shops from which you buy. Select clean places. All bakery food should be under glass. Do not buy any food that has been exposed to the dust of the street. Insist that the grocer and the market man shall have screened windows and doors. Notice if the market has floors, walls, and so on, that can be readily washed. Has the market man or the fish man a good cold storage place? The odor in a meat or fish market will soon tell you whether the place is clean or not.

Study very carefully those places that advertise special sales, bargains and cut rates. It may be that these are all right, but sometimes inferior goods are put into the bargain sale. Bargain eggs are sometimes a mixture of large and small, semi-fresh and decidedly stale eggs. In large cities it is true that on Saturday evening good material can be bought at a low rate.

Select Reliable Dealers

Have a set of weights and measures at home to protect yourself. The Federal Government passed a law in 1914 requiring that all goods purchased in packages shall have their weight stated upon them. There are, however, many tricks of the trade, and the only way that you can be sure of getting your money's worth is by having a standard set and weighing what you purchase. If your dealer knows that you are doing this he probably will give you honest weights and measures. Notice how your meat is trimmed.

Checking Weights and Measures

When food is kept at home it must be kept clean and dry, and perishable food must be kept cool. Have a good refrigerator if possible. If you cannot have this, perishable foods, like milk, meats and fish must be purchased in small quantities. The semi-perishable foods—butter, eggs, and cooked foods—will keep for a time outside of the ice box, but must be in the coolest place possible. A window-box will help, especially if netting is inserted to allow a current of air. Have glass jars and tin boxes for keeping other kinds of food. The amount that you can keep on hand

depends upon your storage space. It is cheaper to buy in quantity if you have a large pantry.

Clean hands and clean clothing are absolutely essential for those who do the handling of the food and the cooking.

A clean kitchen is also an absolute essential. Everything in the kitchen should be washable and kept clean as soap and water and scrubbing can make them. Dirty dish cloths and towels are nothing less than an abomination. Where there is plenty of boiling water, dishes should be dried on a rack and the dish towel abolished as much as possible. This is the safest practice according to the latest scientific investigations.

How Shall We Plan Our Meals

The daily planning of meals is indeed the hardest question of all. We may buy food economically, we may cook it palatably, but if we do not make good food combinations in proper quantities for the family, we have not yet learned all of our food lessons.

About the Sunday Meals

A meal may be defined as an assemblage of several kinds of food served together at one time. Meals should be regular. It is not only important to have meals at just the same time every day on the housekeeper's account, but for our own health. Meals of the same amount should be eaten at the same time each day. The change on Sunday of the time and kind of meals is fruitful of much discomfort on Monday. Try to make some plan for having all Sunday meals at the same hours as week days. If the family must have an extra nap on Sunday try to arrange so that it comes at some other time of day rather than at the morning hour.

Breakfast, luncheon and dinner, or breakfast, dinner and supper are the three standard American meals. Here are three sets of plans for these meals:

Typical Breakfast Plans

I	II	III	IV	V
Fruit	Fruit	Fruit	Fruit	Fruit
Toast	Cereal	Meat	Cereal	Cereal
Beverage	Toast	Toast	Meat	Meat
	Beverage	Beverage	Toast	One other hot dish
			Beverage	Toast
				Beverage

Typical Luncheon Plans

I	II	III	IV
Hot dish	Hot dish	Soup	Soup
Bread and butter	Bread and butter	Another hot dish	Two other hot dishes
Beverage	Simple dessert	Bread and butter	Salad
	Beverage	Dessert	Dessert
		Beverage	Beverage

Typical Dinner Plans

I	II	III
Two hot dishes (meat and vegetable)	Soup	Soup
Bread and butter	Two or three other hot dishes (as meat and one or two vegetables)	Two or three hot dishes
Beverage	Bread and butter	A relish (as jelly or pickle)
	Dessert	Bread and butter
	Beverage	Salad
		Dessert
		Beverage

You can see that all the food stuffs are present in all these meals in whatever form. Where there are fewer dishes there must be more of each single dish. One can observe a few simple rules that will help to give variety. It is natural for us to seek variety and to object to meals that are quite alike day after day. Take one of the dinner plans, for instance; have one vegetable a starchy vegetable like potato, or have rice or hominy in place of potato once in awhile. Have one of the two vegetables green like spinach or asparagus in season. Do not have two or three of the root vegetables together like beets, turnips and carrots. If you have an acid soup at the beginning of the meal do not end it with an acid fruit. If you have a milk soup at the beginning of the meal do not have a milk dessert at the end. If there is meat left over for another meal, and you have a place to keep it without spoiling, do not serve it at the next meal.

Some of our natural desires are proved to be good by science, as for instance our liking bread with butter; of potatoes and gravy with meat; of something acid with fish; of cranberry sauce with turkey; of apple sauce with pork. On the other hand some of our habits and tastes are not a safe guide. Griddle cakes with maple syrup, followed by sausage or pork chops, are a poor combination except for some person with strong digestion who has to work with his muscles in the open air all day. This leads us to the next question.

Different Diet for Different People

Different people need different kinds and amounts of food. A small person needs less food than a large one. Men seem to require more food than women. A man working hard all day in the open air needs more food than a man sitting at his desk, and can digest foods that a person living in doors can not. The baby and the child need less food than the grown-up, but it must be of a kind that builds the body, like milk, eggs and grains.

How can we measure our food? Scientists have learned to measure the amount of energy needed daily by people of all ages and sizes, and they know how much energy each kind of food will yield. The energy is expressed in terms of heat and the heat is measured by a unit, just as we measure heat by the degrees of a thermometer, or the length by the inches on a foot rule. The unit taken is enough heat to raise one pound of water 4° F.; or one kilogram of water 1° C. This heat unit is called a calorie, which comes from a Latin word *calor*, heat, and

Measuring the Energy

it means nothing but a heat unit.

Here is a table for a family of five, showing how many calories they need a day.

Food Requirements

Members of Family	Age	Weight	Total Calories	Protein Calories
Man	40	154	2680	268-402
Woman	38	120	2160	216-324
Girl	16	110	2200	220-330
Boy	12	75	2250	225-338
Boy	6	40	1600	160-240
Total requirements			10,890	1089-1634

Food

	Calories	
Milk	20	(6 for each child, the rest for the adults.) (One quart of milk yields 6¾ portions.)
Cereal	5	
Eggs (for children	2	Counting 2-3 portion per egg.
Fruit	5	
Green vegetables	2	
Meat or meat substitute	5	
Bread	15	
Butter	15	

The energy given by the protein is put in a separate column to warn us against eating too much protein, especially in the form of meat. Let us now take a list of the foods that we should be likely to have in one day, allowing for the children the materials that make for growth.

100-Calorie Portions

The 100-calorie portion is convenient to use in making up menus. Roughly speaking an ordinary slice of bread is 100 calories. A square piece of butter that we put on a butter plate is 100 calories. An ounce of cream cheese is about 100 calories. About 2-3 of an ordinary glass of milk, weighing a little over five ounces is 100 calories. A very large egg gives 100 calories.

Here are menus made up with the kind of food that should be included.

Menu No. I:

Breakfast

Oranges
Flaked Wheat
Twice baked rolls and butter
Milk for children

Luncheon

Creamed salmon on toast
Peas
Graham bread and butter
Stewed pears
Milk to drink

Dinner

Clear tomato soup
Roast beef
Mashed potatoes, string beans
Cabbage salad
Lemon jelly, whipped cream
Milk for children to drink

Menu No. II:

Breakfast

Grapes
Oatmeal
Toast with butter
Cereal café au lait for children

Luncheon

Eggs au gratin
Stewed tomatoes
Bread and butter
Raspberry tapioca
Cocoa

Dinner

Julienne soup
Roast beef
Creamed macaroni, spinach
Celery and nut salad
Pineapple ice, lady fingers
Milk for children to drink

Following this is a table which will show you how to calculate 100 calorie portions:

Food Material	100-Calorie Portions	Total Calories	Protein Calories
Oranges	2.5	250	28
Flaked wheat	5.0	500	74
Rolls	5.0	500	61
Milk for children	6.0	600	114
Thin cream for cereal	5.0	500	26
Butter for rolls	5.0	500	5
Sugar for coffee	1.0	100	..
Creamed salmon			
Salmon	3.0	300	160
Milk	2.0	200	38
Flour	0.3	33	4
Butter	2.0	200	2
Toast	3.0	300	43
Peas	2.5	250	70
Butter for peas	1.0	100	1
Graham bread	5.0	500	68
Butter for bread	5.0	500	5
Pears	2.5	250	8
Sugar for pears	2.0	200	..
Milk to drink	6.0	600	114
Tomato soup			
Tomatoes	0.5	50	10
Butter	2.0	200	2
Flour	0.3	33	4
Roast beef	5.0	500	138
Mashed potatoes	5.0	500	52
Milk	1.0	100	19
Butter	1.0	100	1
String beans	0.5	50	11
Butter for beans	1.0	100	1
Bread	5.0	500	72
Butter	5.0	500	5

Food Material	100 Calorie Portions	Total Calories	Protein Calories
Cabbage salad			
Cabbage	0.5	50	10
Lettuce	0.1	10	..
Heavy cream for dressing..........	2.0	200	4
Lemon jelly			
Gelatine	0.5	50	45
Lemon juice	0.1	10	..
Sugar	4.0	400	..
Whipped cream			
Heavy cream	3.0	300	7
Milk to drink......................	6.0	600	114
		10,583	1,286

Of course it is not to be expected that any housekeeper can do this every day, but if she will take a little trouble to check up her meals she will soon learn whether or not she is giving her family enough or too much of any one kind of food.

The Cost of Meals

It does not follow that because we spend a great deal on our meals that we are getting the best value for our money. In an investigation of all costs it was found that some people who are spending as much as eighty cents per capita are not giving enough mineral content to their families. They are not so well off as women spending only eighteen to twenty-five cents per capita per day and buying the plainest of foods. The smaller the income the higher percentage must be paid for food for we cannot go below a certain amount per day and be nourished. Food prices have risen so tremendously in the last decade that nourishment cannot be provided below eighteen to twenty-five cents per capita per day. The only way to keep the energy and body building values is to substitute cheaper materials right through; less butter and cream, more beef fat and cottonseed oil. The cheaper cuts of meat, vegetables in season, or dried and canned, out of season. Remember that bread always ranks among the cheaper foods on account of its great food value. Here is a table that shows this:

Amounts of Protein and Energy Obtained for Ten Cents Expended for Bread and Other Foods at Certain Assumed Prices Per Pound

Food Materials	Price		10c will buy Ounces	10c worth will contain Protein Ounces	Fuel value of Calories
Wheat bread..	$0.05	per lb.	32.0	2.9	2400
Cheese	.22	per lb.	7.3	1.9	886
Beef, average..	.20	per lb.	8.0	1.2	467
Porterhouse stk.	.25	per lb.	6.4	1.3	444
Dried beef	.25	per lb.	6.4	.1	315

Food Materials	Price	10c will buy Ounces	10c worth will contain Protein Ounces	10c worth will contain Fuel value of Calories
Eggs	.24 per lb.	10.0	1.3	198
Milk	.09 per qt.	38.3	1.2	736
Potatoes	.60 per bu.	160.0	...	2950
Apples	.0½ per lb.	320.0	...	1270

It is only through the most careful planning and buying and the using of meat substitutes that money can be saved and the nutrition value kept up to standard.

As Regular as a Clock

When things go just a certain way,
As steady as can be,
They're "regular as a clock," we say;
Now, that's what puzzles me.

A clock's not regular at all;
I know this for a fact—
So don't depend upon it when
You want to be exact.

Now, our clock, why it's just as sure,
When I am having fun,
And bedtime hour is drawing near,
To break into a run.

And through the night it gallops on
Until, to my surprise,
It's morning, and I know that I
Have hardly closed my eyes.

Then when I go to see the boys—
I often wonder why—
The hours go by so very fast,
They seem to fairly fly.

But then, sometimes, when I'm in school
It's just the other way;
The old clock goes so slow, so slow,
It seems the longest day.

And when it's near vacation time,
That is the worst of all;
It's slower than the slowest snail;
It scarcely seems to crawl!

A clock's not "regular" at all;
I know this for a fact—
So don't depend upon it when
You want to be exact.

The Boy and His Workshop

Carpentry Class in a Public School

THERE is nothing that a boy can do that is more real fun than "making things." To be sure some of the things that a boy wants for his room or for his sports may be purchased, but the money they cost will soon fit out a boy's workshop where he can learn to make most things he would otherwise buy. He will also be able to make many things not easily purchased, for himself, for his home, and for his friends. There is a certain delight in making and doing for one's self that is gained in no other way. Things you make

The Joy of "Making Things"

you prize much more highly than those you buy, for into them you have built a part of your own self —your thought, your labor, and your skill. They are your attempt to do as your primitive ancestors did, to make your material surroundings better suited to your needs.

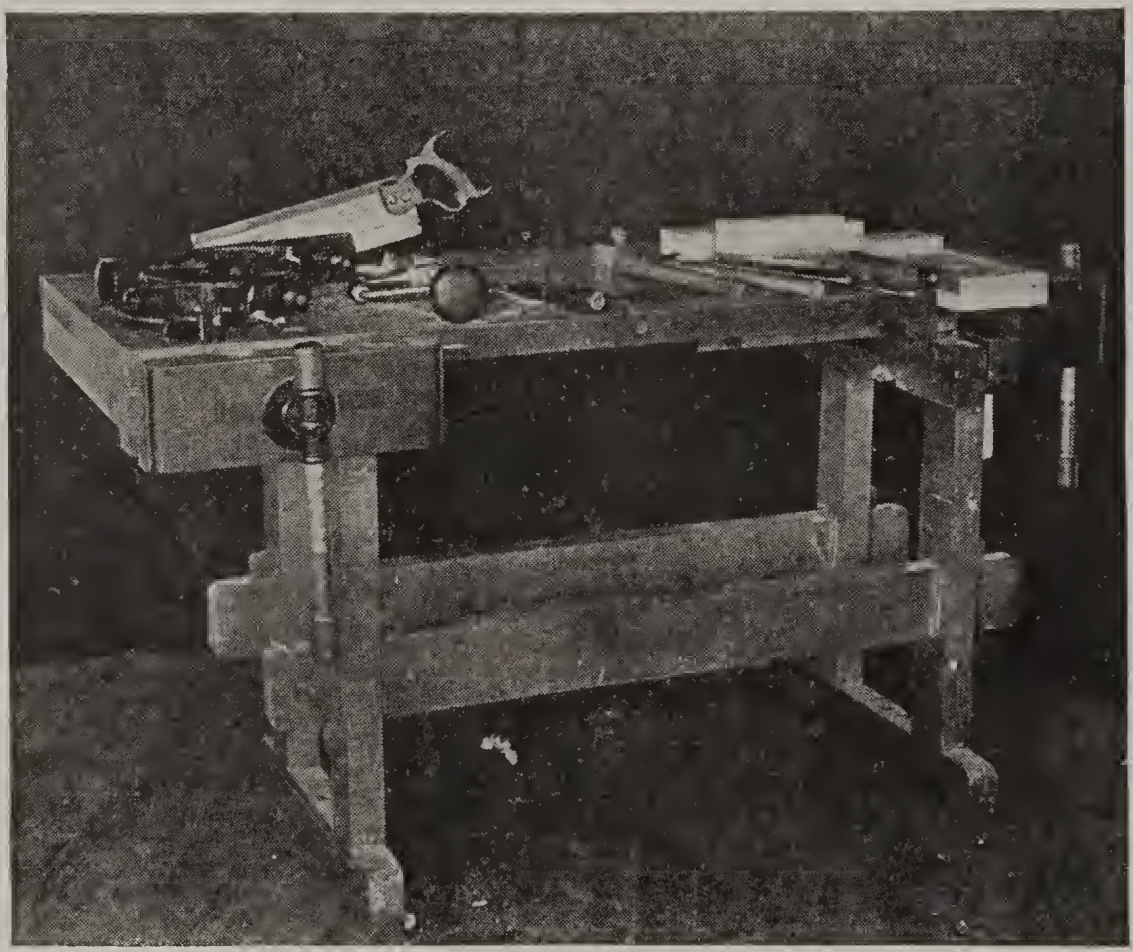
The Educational Value of Making Things

Besides the satisfaction, the experience of making and doing is of the greatest educational value to a boy, for by it he becomes familiar with many of the tools and materials of industry. His interest in the world of construction and artisanship is awakened, for he has himself become a part of it. But, best of all, he is forming habits of self-reliance, perseverance, and thoroughness that will stand him well in hand, no matter what vocation the later years of his life may call him to take up.

Now it is not essential to have an extensive equipment with which to begin. Much may be done with only a few of the more common tools. Of course it is best to have some room or corner of a shed or basement that may be considered the workshop, but even this may be left out at first. The things essential for the beginner are a clean, roomy, dry place in which to keep tools when they are not in use, a few good tools, a little inexpensive lumber, some nails and an ample and permanent supply of determination and "stick-to-it-ive-ness."

Elaborate Outfit Not Necessary

Fig. 1. A Well Equipped Work Bench



Assuming that my young reader has the first and the last two of these items, let us secure the others and begin doing and making things.

While it will be possible, later, for you to make your own work bench, you will need one almost at the start. For this reason it will be the best plan to have one made by some local carpenter or, better still, to secure one similar to the one shown in Fig. 1,

About the Work Bench

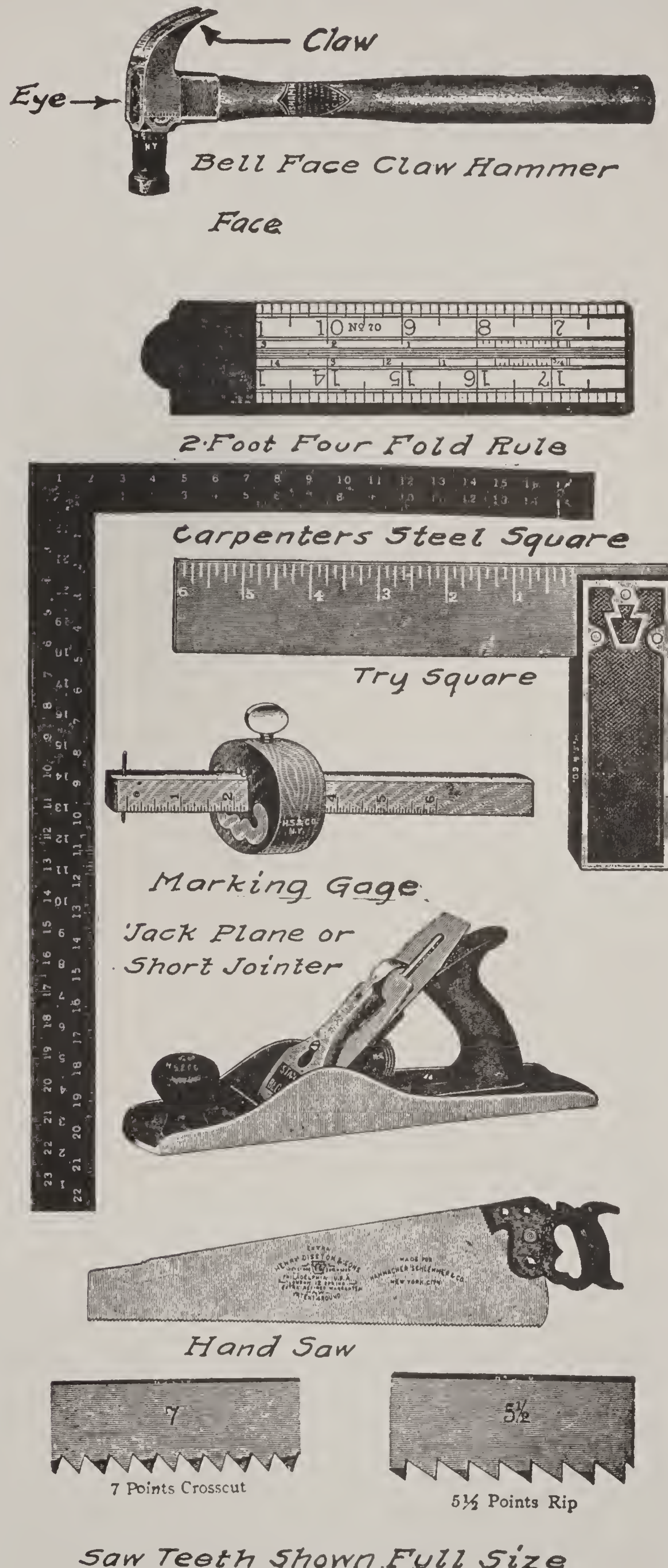
which is the kind used in all manual training schools. Your local hardware dealer will secure one for you. If you have one made, it should be about 5 feet long by 2 feet 4 inches wide by 2 feet and 8 inches high, and a side vise and a tail vise similar to those shown in Fig. 1 should be provided. The tail vise should have an adjustable peg in line with a row of peg holes in the bench top. Place the bench where there is good light and fasten it securely to the floor.

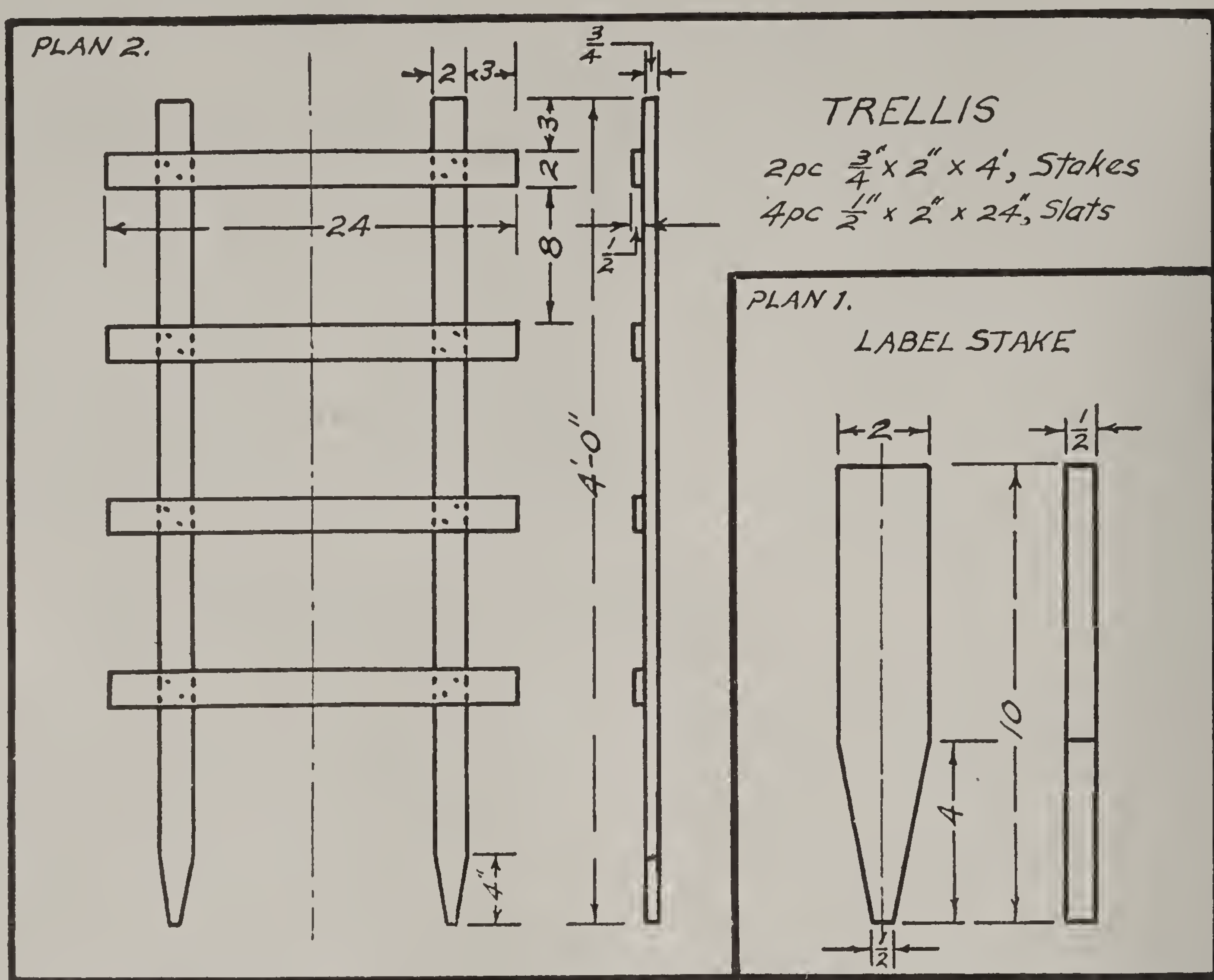
Selection of the Tools

To start with, obtain from your hardware dealer, in a good quality, the following tools: a 16-ounce, bell face, adze-eye hammer; a 2-foot fourfold ruler; a carpenter's steel square; a try square with 6-inch blade; a marking gage; a 14-inch, corrugated bottom, iron jack plane; and two hand saws—one a 24-inch, 7-point, crosscut saw and the other a 26-inch, 5½-point, rip saw. You can see by the illustration the exact size and shape of the teeth and the difference in appearance in these two saws.

The Care of the Plane

Just a word about your plane and how to remove the blade for sharpening. The bottom is called the *sole,* the front end the *nose,* the back end





Garden-Line or Clothes-Line Winder

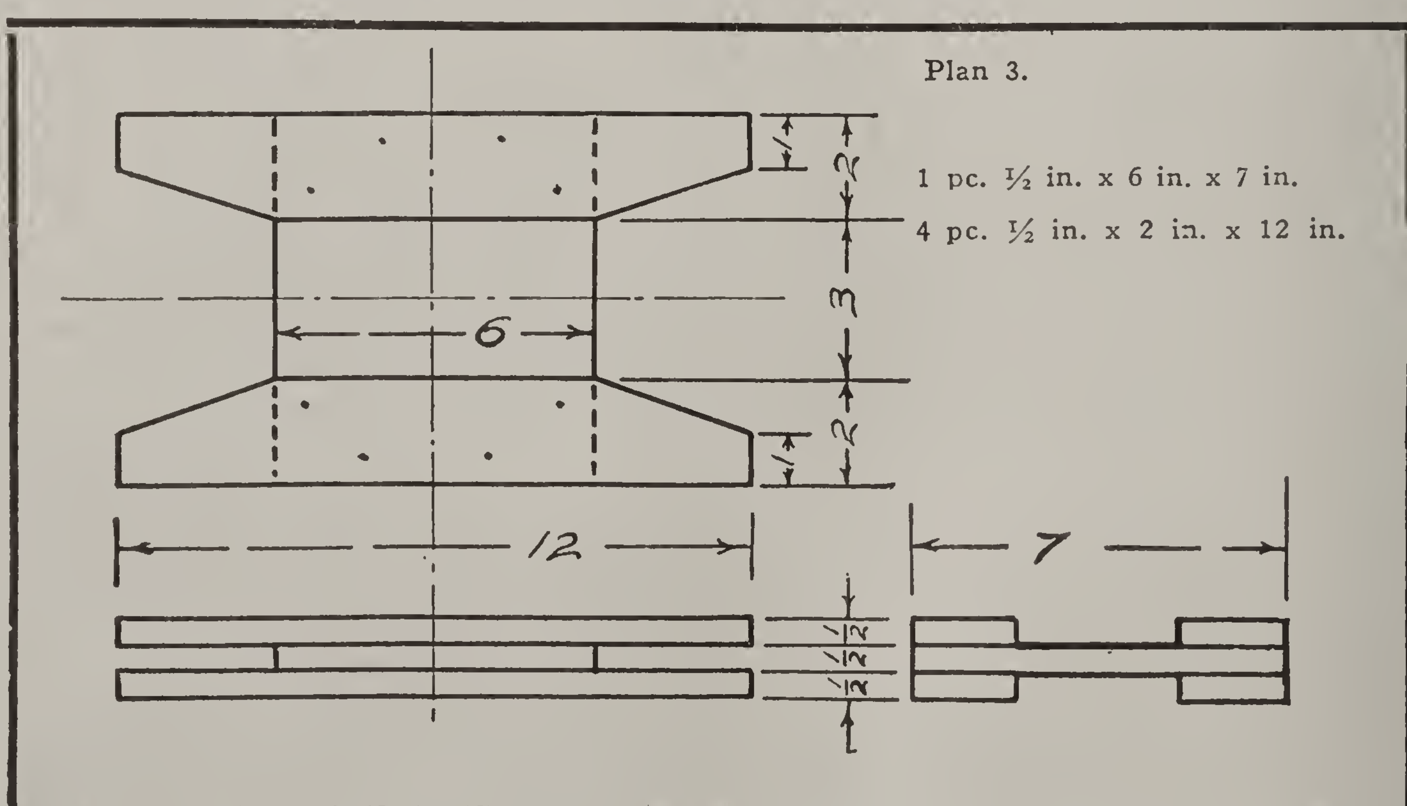
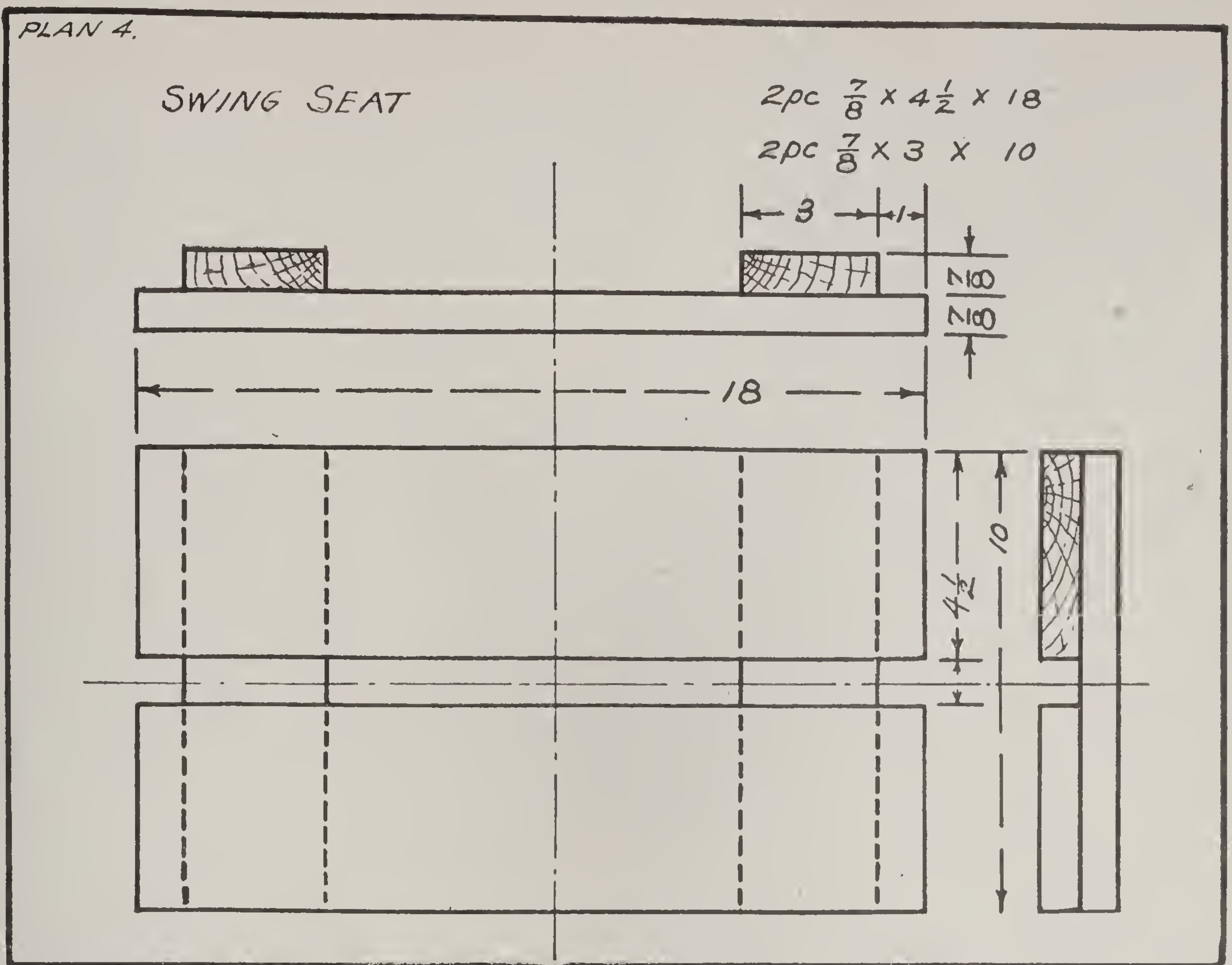


Plate I

Plan 1. Label Stake. Plan 2. Trellis. Plan 3. Garden Line.



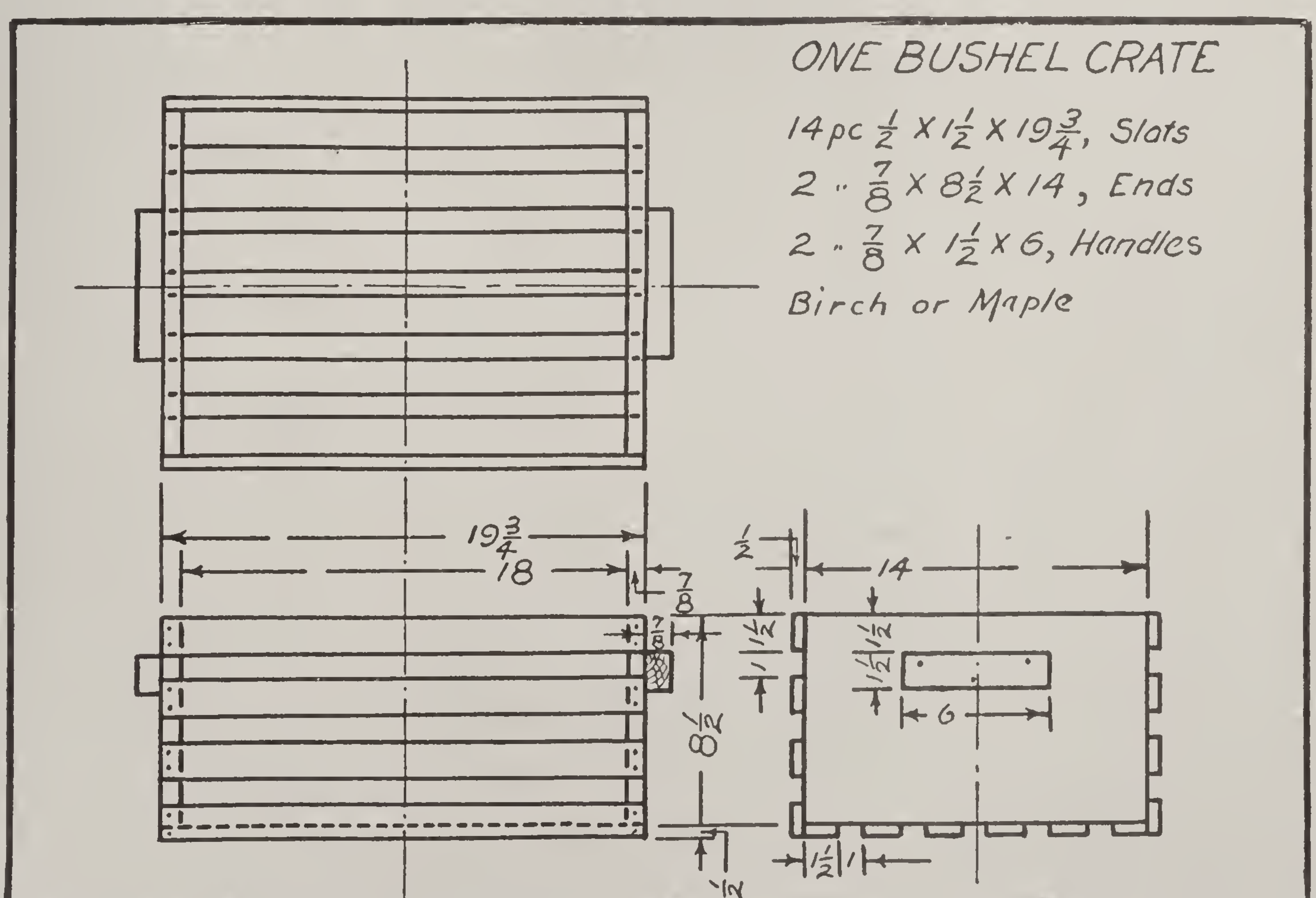


Plate II

PLAN 4. SWING SEAT

PLAN 5. ONE BUSHEL CRATE

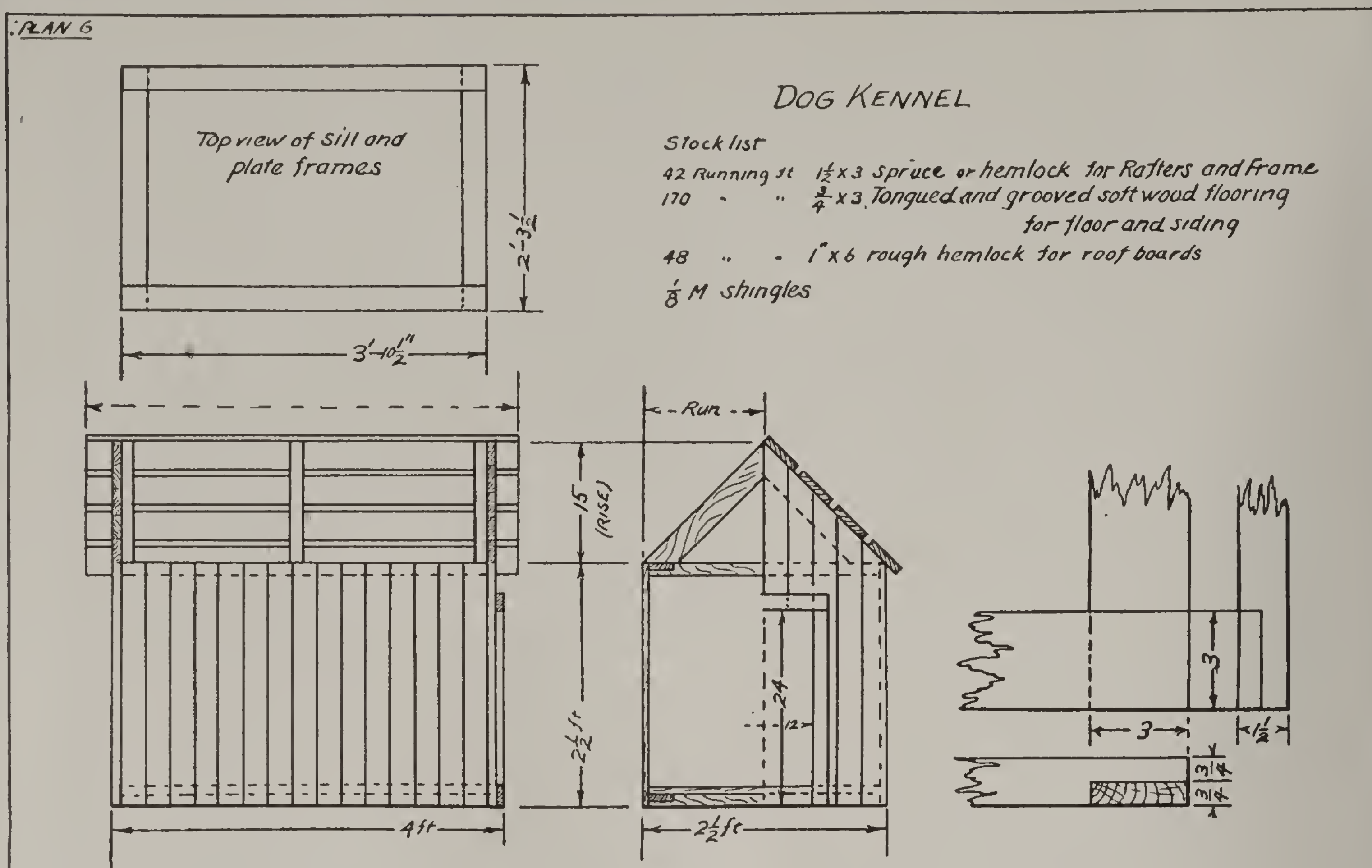


Plate III

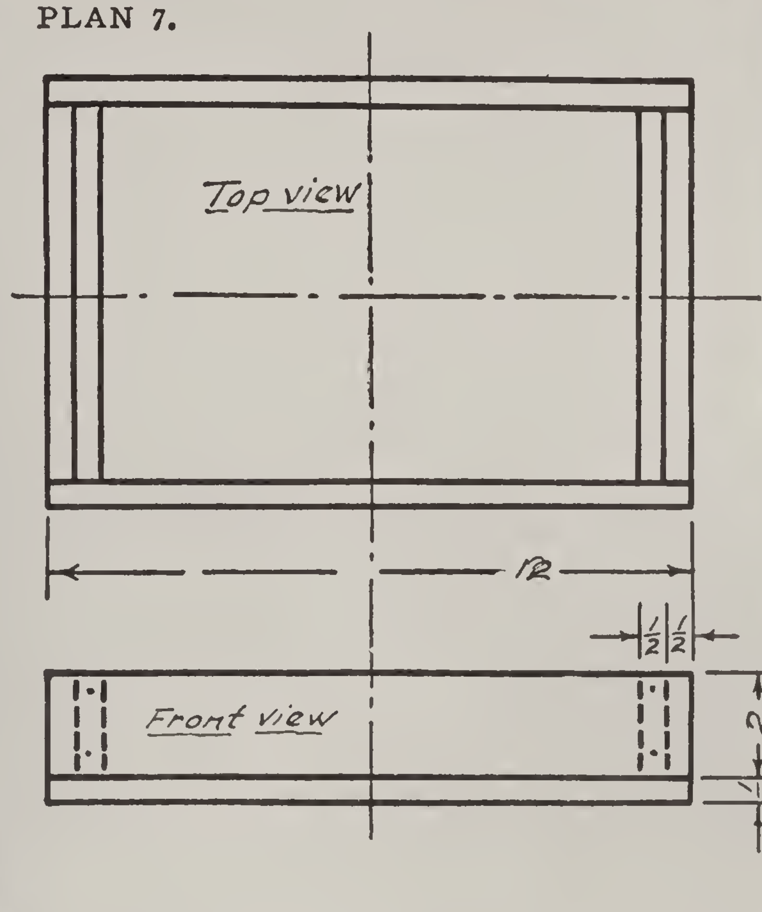
the *heel,* the opening for the shavings the *throat.* Underneath the handle is the set-screw which "drives" or "draws" the blade so that it will take a thick or thin shaving. Above the handle is a little lever that sets the blade edge squarely across the sole. The part that holds the blade in place is called the *wedge.* To remove this, release the little lever at its top. The blade and cap may now be taken out. The purpose of the cap, which is fastened to the top of the blade, is to break or curl the shaving. The plane would not cut smoothly without it. The space between the edge of the cap and the edge of the blade should be about 1/16 of an inch. To remove the cap-screw, use the point of the wedge as a screw-driver. Separate the cap and blade, sharpen the latter and adjust for work as explained in Fig. 2.

Setting a Plane Blade

After a plane blade has been sharpened, it should be fastened to its cap and very carefully replaced in the plane to avoid dulling the edge. After the wedge is locked in place with the setscrew underneath the handle, adjust the blade so it will project only a hair's breadth below the sole.

To start you will need to have some local mechanic sharpen your saws and jack plane, for these tools are never properly "fitted" when they come from the hardware store. But soon you will be able to "fit" your own plane blades and other "edge tools," which is

PLAN 7.



PLAN 8.

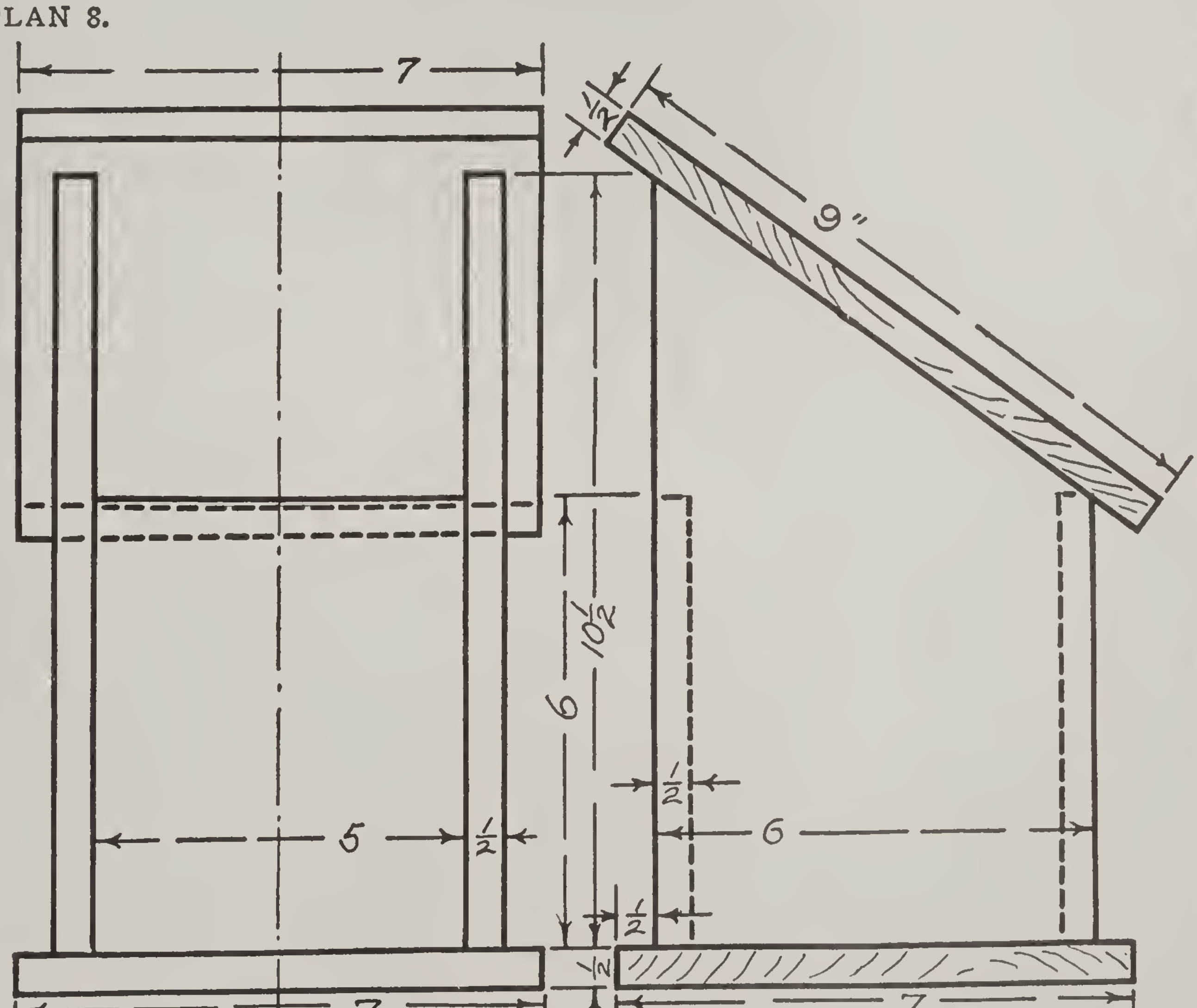


Plate IV

Plan 7. Seed Germinating Box.

Plan 8. Bird House.

as shown below in Figs. 3 and 4.

Nails are known as common nails —those with large flat heads, and finishing nails—those with small heads that can be set even with the surface. As to size, they are called "2-penny," "3-penny," and so on. You will need a small quantity of 2-, 3-, 4-, 5-, 6-, 8-, and 10-penny in both kinds. Label each package.

Kinds of Nails You Need

Figs. 3 and 4. How to Hold Chisels and Plane Blades to Sharpen.

These illustrations show clearly how to hold chisels and plane blades to sharpen on the oil stone. Where only one stone is used it should be of medium grit. It is better to have two—one coarse for rapid sharpening and the other fine for finishing. Sharpen with a rotary movement on the bevel side of the tool as in Fig. 3. Keep the bevel flat on the surface until nearly through, when the handle may be raised a trifle for the last two or three strokes.

A rough-turned edge will be produced, which must be reduced as indicated in Fig. 4. Be sure to keep tool perfectly flat on stone. Beveling the tool on this side will spoil it. You may have to reverse the tool several times before you obtain a smooth edge. The last strokes should be very light ones from the bevel side.

Keep the points of chisels square. The points of plane blades should have the corners a little shorter than the center.

After tools have been "stoned" until the flat bevel has been destroyed or much shortened, they must be reground.

In this way you will soon learn to know the various sizes at sight. Later you can make some boxes with compartments to hold nails, screws, and other small hardware.

The Supply of Lumber

As to the lumber, for the first roughly finished out-of-door things some inexpensive soft wood will be best. Sometimes packing boxes that can be had from the local stores can be used, but be sure to remove all the nails. Basswood, spruce, and "second-growth" soft pine are the best kinds to secure from the lumber yard. Have the lumber "dressed" on two sides to the thickness desired. A good convenient supply will include some $\frac{1}{4}''$, $\frac{3}{8}''$, $\frac{1}{2}''$, $\frac{5}{8}''$, $\frac{3}{4}''$, and $\frac{7}{8}''$. Notice the stock list with each drawing. For some of the projects, especially the pieces of furniture made from oak, it will be best to have the stock cut to the dimensions here given at the mill.

Packing Boxes May Do

Study Your Stock List

How to Read Working Drawings

Speaking of drawings, if you have ever observed carpenters or mechanics at work, you have no doubt noticed the "blue prints" to which they constantly refer for directions. These blue prints are working drawings that give dimensions and all other information needful for construction. As it will be necessary for you to work from such drawings, suppose we next learn to read working drawings.

In Plate IV, Plan 7, is a photo-

Fig. 5. Using the Crosscut Saw

This boy has a very good working position for sawing. Notice the direction of the forearm—straight with the saw. In starting the saw, steady it against the left hand and touch the wood but lightly. In cutting off long heavy pieces be careful that they do not split off at the last of the cut.

graph of a box suitable for soil in which to plant seeds in the early spring, and the working drawing of this box. Notice that there are three views, the top, the front and the end. Sometimes objects may be fully described by only two views, as the label stake in Plate I, Plan 1; others need section views and detail sketches, as the dog kennel in Plate III, Plan 6. Notice that all the edges that can be seen from any one of the three view points are represented in that view by full heavy lines. Edges that are invisible are com-

The Meaning of the Lines

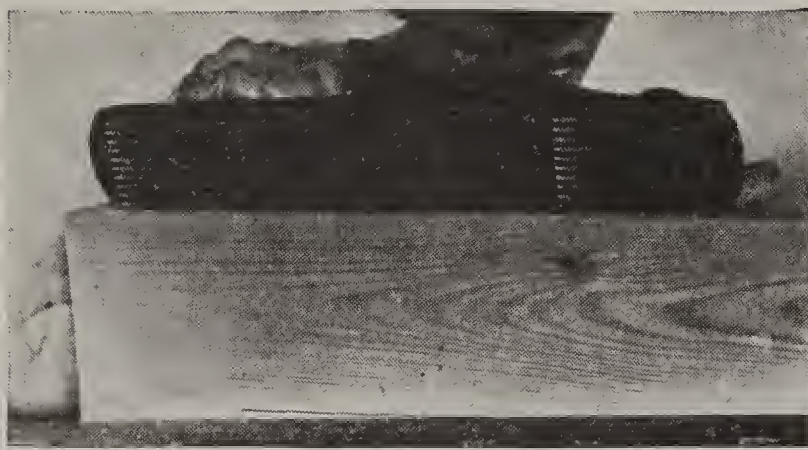
posed of short, heavy dashes, e. g., in the front view the invisible ends of the end boards. Examine other drawings for visible and invisible lines and think out what they mean. Fine lines made up of a long dash and a small dot are center lines. Note their location in each view. The broken medium lines with arrow heads at each end are the dimension lines and are drawn between the extension lines. In the dimension lines are placed the dimensions that show the sizes of each piece and other measurements needed in putting the box together.

Fig. 6. Edge Planing

In edge planing, or "jointing" as it is often called, assuming that your plane is properly sharpened and set, grasp it firmly in the manner shown in the illustration. Begin with the nose only, on the end of the surface to be worked, so that the blade may begin to cut at the very end of the board. Press on the front end at the beginning of the stroke and on the rear end of the plane at the close of the stroke. Take strokes the entire length of board. You will not get a shaving the whole length until several strokes have been made. A thin shaving the whole length will indicate that the edge has been jointed. "Sight" along it as you would along a gun to see if it is straight. If you carelessly allow the plane to drop at either end of stroke it will be high in the middle; do not worry over making it hollowing.

If testing with the try square shows one side to be higher than the other, move (do not tip) the plane over so the middle of the blade will reduce the high edge.

Fig. 7. Testing Trueness



This illustration shows the method of testing edge of board with corner of plane to see if edge of board is straight.

Study these dimensions until you discover the facts given in the stock list. Find how far the end board is placed from the end of the box. Notice that when similar dimensions are alike, they are not repeated; for example, thickness is shown on but one side board. Sometimes if the stock of an entire project is all of the same thickness, that fact is stated in the stock list and omitted from the dimensions on the drawing.

How to Use Your Tools

To explain the use of tools in written language is very difficult, so you must examine carefully the pictures of the boys at work, Figs. 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14. Notice particularly the position of the boys, of their hands, and of the tools and lumber. Study the note of instruction under each picture and whenever you get a chance watch carpen-

Notice How These Boys Are Doing It

Fig. 8. Testing With Try Square

This shows the method of holding the try square for proving if a surface be squared with the face of the stock and true. Hold the handle of the square firmly against the face side or edge, draw the tool along the length of the piece, watching if the blade touches the surface evenly at all points.

If the surface proves inaccurate, carefully reduce the high places with the plane. This boy is making a table post. Notice that he has glued three thin (¾-in.) pieces together to get the required thickness. The joints should be cut in the "faces" of the stock.

Fig. 9. Marking Gage

The marking gage is one of the hardest tools to learn to use. When the tool is new the spur should be filed to a knifelike point which projects through the beam about $\frac{1}{16}$-in. File the outer side of the spur perfectly flat, parallel to the surface of the head and the inner side slightly rounded away from the head.

Having the gage set with the desired distance between the spur and the head, grasp it as shown in the illustration. Keeping the head firmly against the face edge of the stock and the farther lower corner of the beam in contact with the surface of the stock, lower by a turning movement, until the spur is lightly in contact with the wood. Push the gage from you.

Fig. 10. Using the Rip-Saw

This is the best position in which to hold a board to make a cut lengthwise. Short pieces are, however, cut most conveniently if fastened in a vertical position in the vise of the bench. Always leave a small space between the saw and the line. Be sure to cut squarely through the board. A try square held back down near the side of the saw will help you to do this.

Notice the boy's general position and the angle at which the saw is running with the wood. Do not crowd or bear on the saw; if it is properly filed, it will run straight and cut rapidly without pressure.

To correct the direction of the cut twist the saw lightly; do not bend it.

Fig. 12. How to Hold Try Square

This shows the manner of holding the try square for laying out a line across the stock. As the edge of this board is still rough, it will be used for a piece of rough stock. For finishing cuts or for joints, one side and one edge of the lumber must be planed straight and square and used as "face side" and " face edge" from which all measuring and squaring must be done.

For fine, accurate work, as in cutting joints, learn to draw lines with a sharp knife-point instead of with the pencil.

ters at work and learn from them.

Now let us "get out a piece of stock," say for the garden stake in Plate I, Plan 1. This you will see from the drawing, is ½″ × 2″ × 10″ (thickness by width by length). Select a board the right thickness and with a crosscut saw, Fig. 5, cut

Fig. 11. Measuring

This boy is measuring the length of a piece with the steel square. He would proceed in the same manner if he was using a ruler. The important thing is to have the ruler on edge so the markings on the scale are close to the surface of the stock.

Have your pencil well sharpened and *be accurate.* Sometimes for very particular work a knife-point is better than a pencil.

off a piece about an inch longer than the finished stake. Fasten this in the side vise of your bench as in Fig. 6, and plane the edge straight and square. When you have the edge right, measure off the width with the marking gage, Fig. 9, and with the rip-saw, Fig. 10, cut off the piece, leaving about ⅛ inch between the saw and the gage line. Plane to the gage line; do not plane beyond it. Learn now, once for all, how to re-

Fig. 13. Nailing

This boy is nailing a box together. Notice the way in which he holds his hammer. For light nails the hammer should be swung with the wrist; for heavier work the whole forearm is used. Try to hit the nail squarely on the head with the bell face of the hammer and send it in even with the surface without bending the nail or marring the wood. Use much care in placing nails so they will not come through.

spect your lines; if you cut them out, you are lost and your work is wrong for you will have made it too small. Last of all lay off the length with ruler, pencil, Fig. 11, and try square, Fig. 12, so as to cut off both ends square with the crosscut saw.

This is the complete process of "getting out a piece of stock" by hand. It must constantly be repeated, so you must learn it perfectly at this point.

Teach Yourself Thoroughly

Where there are to be several pieces of the same width, as in the trellis, Plate I, Plan 2, get out stock all in one long piece, then cut to length.

To finish the garden stake, lay out the lines for sharpening, cut nearly to them with the knife or rip-saw, and finish with the plane. Make several stakes for practice, endeavoring to get them all alike. Learn to be accurate. Be satisfied with nothing that is wrong.

The only new work on the trellis is the nailing, Figs. 13 and 14. In nailing, observe the following rules: When fastening to the side grain use nails twice as long as the thickness of the piece you nail through. In fastening to the end grain, use nails three times as long as the thickness of the piece you nail through.

Mistakes to Avoid

Pairs of nails should be "toed together." You will readily see that they will hold much better than if driven

Fig. 14. Drawing Nails

If a nail takes the wrong direction, do not bend it; that will only make a bad matter worse. Nails which get a bad start or that are bent in driving should be withdrawn and new ones driven, usually in a new place. In drawing long nails, place a block, as shown, under the hammer head; this will prevent breaking the handle.

In driving nails in hardwood, they bend very easily. They may be driven more easily if first rubbed on a cake of soap.

straight. Never nail closer than absolutely necessary to the ends of stock; it is very apt to split. For the same reason never drive two nails close together in the same longitudinal grain of the lumber.

In nailing the trellis, be sure it is square. Nail on the end of cleats first. Observe the arrangement of the nails indicated on the drawing. Use 2-penny common nails, which you will find about the right length according to the rule in the last paragraph.

The garden line winder, Plate I, Plan 3, and the swing seat, Plate II, Plan 4, present no new processes, but call for increasing skill and accuracy in those already learned. Nail the cleats of the swing seat to the top boards. This will bring the nail heads on the under side out of sight and where they cannot, by coming loose, tear clothing.

If several of the bushel crates are to be made, Plate II, Plan 5, it will be best to have the stock cut at the mill to both the width and thickness required, leaving only the length for you to cut by hand. Nail on the bottom slats first, being sure to keep the work square. In nailing the side slats, remember the rule for nailing to end grain.

Fig. 15. Rafter Cutting

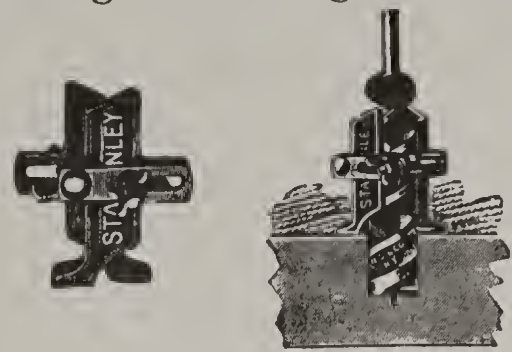
This cut shows the method of laying out rafters, saw trestle legs and other similar cuts with the steel square. The picture is almost self-explanatory. The rise is always the vertical dimension and the run the horizontal. The cuts are indicated by the black lines across the stock by the blade and tongue of the square.

Now for a Dog Kennel!

The dog kennel, Plate III, Plan 6, is rather a large and ambitious project but its dimensions may, of course, be changed if desired. Note that the drawing gives only the essential measurements. The front view is half-section to show rafter plate, floor, and sill. Only half of the door opening and casing is shown. Roof boards are shown on the right side only and the shingling is omitted entirely. Notice that the top view, or plan of the plate and sill frames, is smaller than the outside dimensions of the kennel by twice the thickness of the siding stock. Details of the corner half-lap joint for these frames is given on a larger scale in the right lower corner of the drawing. Cut these joints out with the two saws.

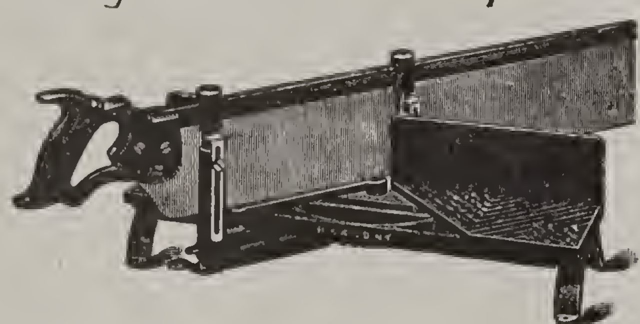
Make the plate and sill frames first, then lay the floor on the latter. Drive the flooring firmly together with a short waste piece, fitting its groove over the tongue of the board last put in place. Blind nail through the tongue, or rather in the corner at the base of the tongue, into the frame with 6-penny common nails, slanting the nails so that when fully driven they will draw the boards firmly to-

gether. This is called "blind nailing" because when the next board is laid, its grooved edge, fitting over the tongue of the preceding board, covers the heads of the nails. All floors are thus laid as you will see if you examine them for head nails.



Bit Gage

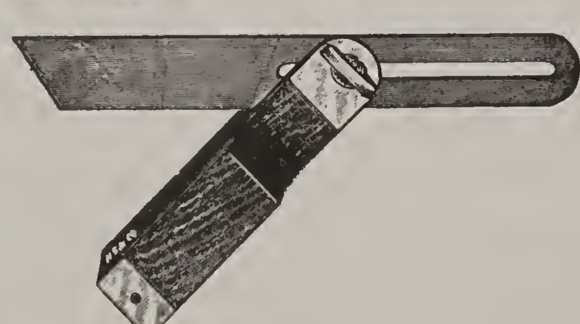
Wing Dividers & Compasses



Iron Miter Box and Saw

Tanged Firmer Chisel

Round Mallet



Sliding T-Bevel.

Expansion Bit

Screw Driver

Study carefully Fig. 15 with the explanatory note and then cut the three pairs of rafters. The rim is half the outside width, the rise is height from plate to peak. Nail them in place on the top of the plate frame and nail their tops together. Next, put siding on the ends, allowing the boards to project above end rafters, afterwards cutting them off "flush" (even) with the top of rafter, using the crosscut saw. In putting on the front, the four boards above the door go on first, then those on each side. Put on the door casing, the threshold, and casings on the corners of the kennel, if needed. Last of all, put on the roof boards—those at the peak first, then those at the eaves. Place the others so that the spaces between the boards will be reasonably even.

Allow the shingles to project over the roof boards one inch all around. Lay the shingles 4 inches "to the weather." Begin with a shingle at each lower corner. Between these stretch a cord one inch from the edge of the roof board. Nail the first course so that the "butts" extend about two inches below the cord.

Shingling the Kennel Roof

Use two nails in each shingle and drive them so that their heads will be covered by the next course. Leave a space of about one-fourth inch between shingles to provide for swelling when wet. Nail the second course with the butts even with the cord and be sure to "break joints," i. e., the shingles of the last course must cover the cracks of the course beneath it. Strike a line 4 inches above butts of second course and lay

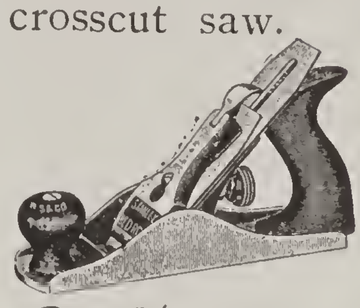
the butts of third course to this line. Proceed in this way until entire side is shingled, then even off the peak and eaves with the crosscut saw. Finish at the peak of the roof with a pair of ½" × 4" ridge boards; the last course of shingles being left at least 8 inches to the weather.

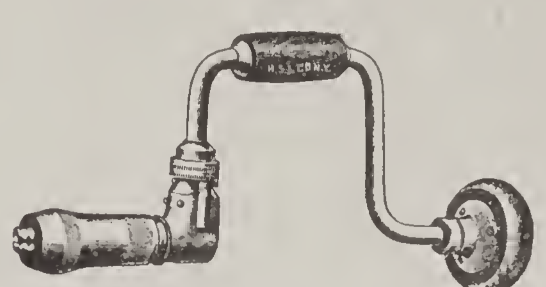
Get a 1½-inch flat brush and a quart of "outside" house paint of any color you like and give the kennel three coats, allowing about 36 hours for each coat to dry. Read and follow the directions given on the can label. Brush lengthwise the boards and see how evenly you can spread the paint. Do not paint the shingles.

Now You're a Real Carpenter

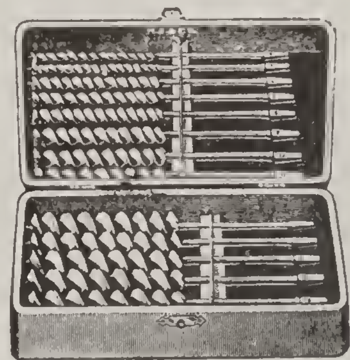
By this time you have enough experience to plan and build a number of things, such as chicken coops, rabbit hutches, hen's nests, bird houses, plant boxes—things whose parts may be cut accurately enough to be practical with the tools you have and which may be nailed together. Now let us get some more tools and attempt some projects that will require finer, more accurate work and different method of fastening.

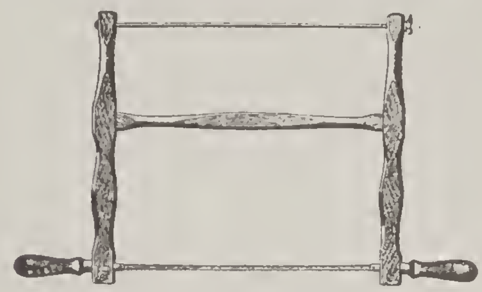
You can now use quite a large additional equipment to good advantage and the following list should be secured if possible:


Smooth Plan


Bit Brace


Nail Set

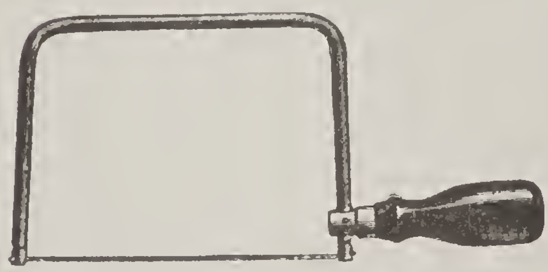

Augur Bits in Sets

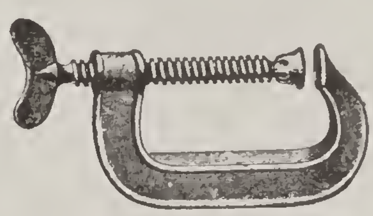

Turning Saw

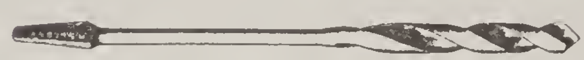

Iron Spokeshaves

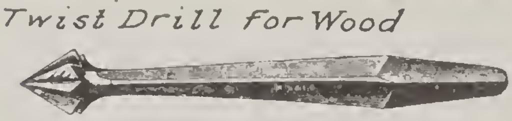

Compass Saw


Draw Shave


Coping Saw

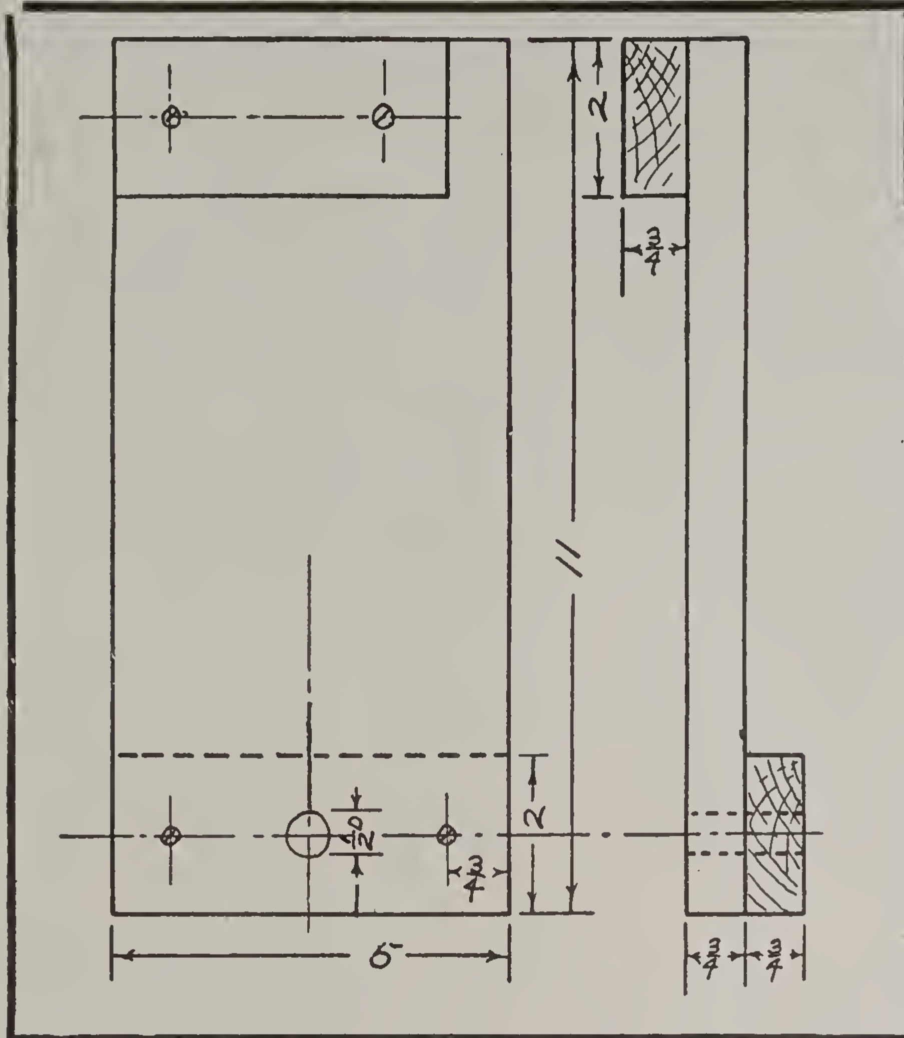

Carriage Makers Iron Clamps


Twist Drill for Wood

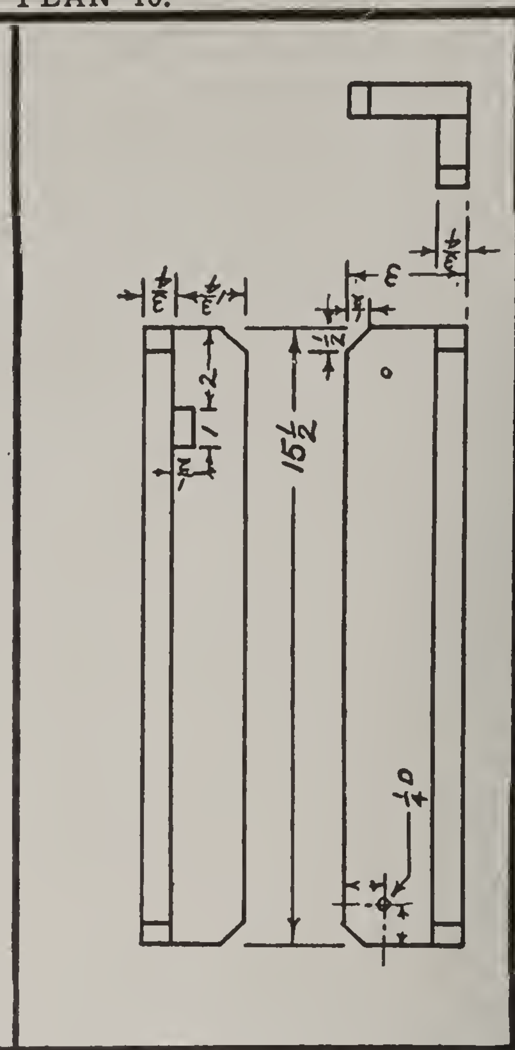

Rose Counter Sink

1——10-inch smooth plane
1——$\frac{1}{16}$-inch nail set
1——$\frac{1}{16}$-inch brad awl
1——pair wing compasses and dividers, 8-inch
1——compass saw or pad saw (for outside curves)
1——12-inch turning saw (for inside curves)
1——coping saw (for curves on thin stock)
1——spoke shave (for smoothing curves)
1——10-inch half-round wood file
1——iron miter box with 24-inch back saw
6——tanged firmer chisels as follows: 1½", 1", ¾", ½", ⅜", and ¼".

PLAN 9.



PLAN 10.

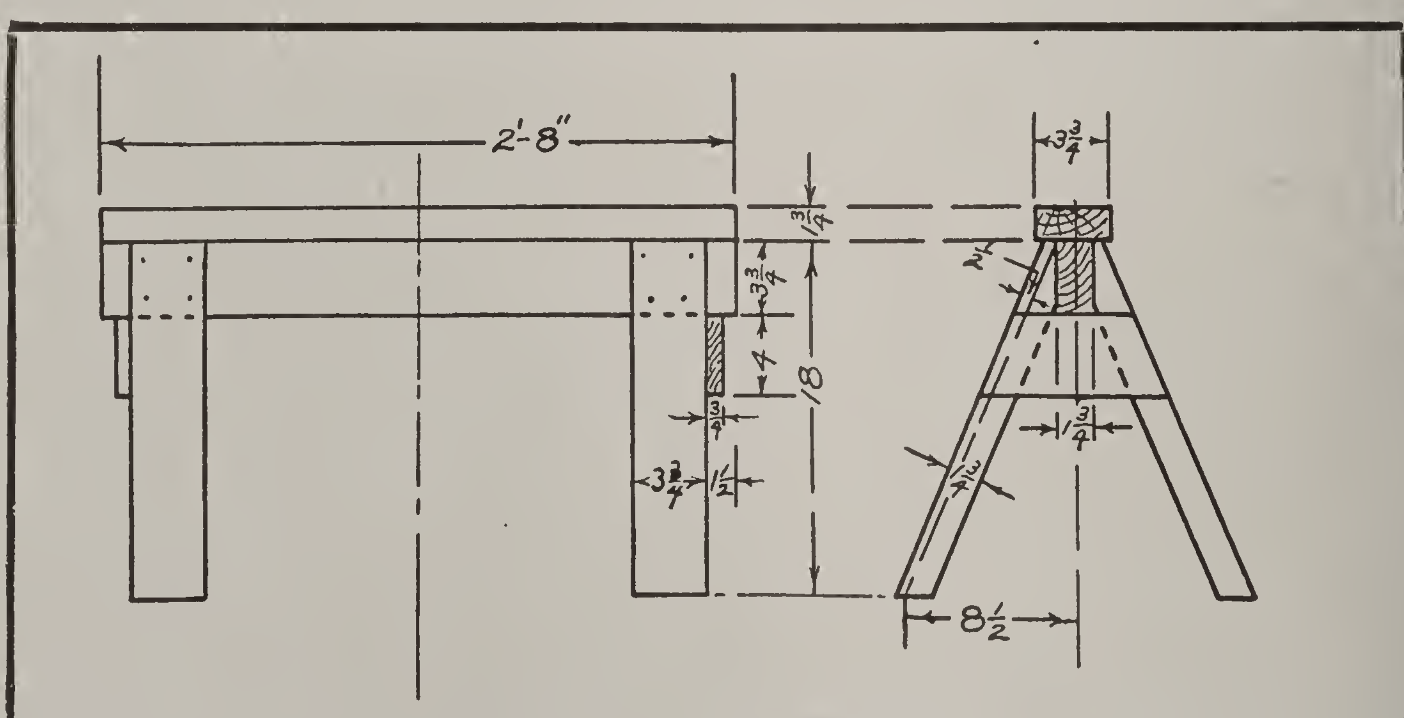


PLAN 9. BENCH HOOK
Stock list, soft pine or whitewood

	Inches
Bench board, 1 piece	3/4 x 5 x 11
Cleats, 1 piece	3/4 x 2 x 10

PLAN 10. TOOL RACK
Stock list, basswood or whitewood

	Inches
Back, 1 piece	3/4 x 3 x 15½
Shelf, 1 piece	3/4 x 1¾ x 15¾



PLAN 11

Plate V

Plan 9. Bench Hook. Plan 10. Tool Rack. Plan 11. Saw Trestle.

PLAN 11. SAW TRESTLE
Stock list, hard pine

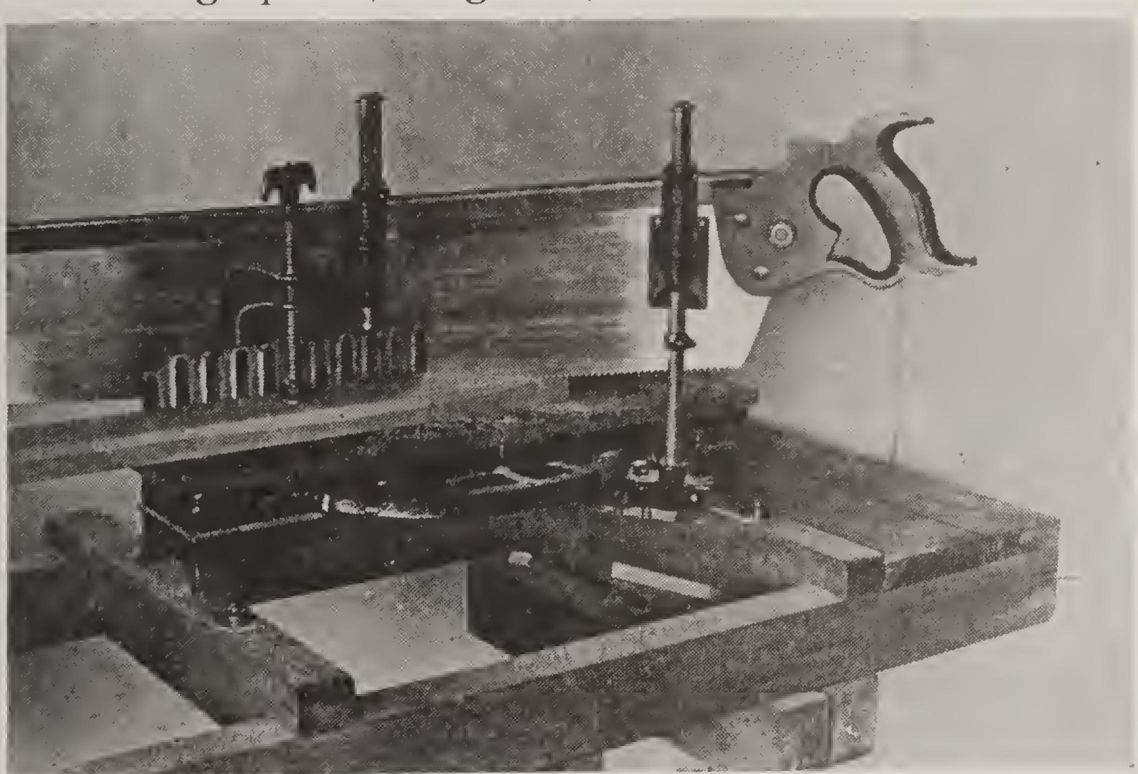
Top, truss piece and legs, 14 running feet of 2 x 4 in. dressed four sides to 1¾ x 3¾ in.
Brace boards, 1 piece, ¾ x 4 x 22 in.

1——round hickory mallet with 3-inch face
1——carpenter's draw shave, 10-inch
1——6-inch T-bevel
2——4-inch iron carriage-maker's clamps
2——6-inch iron carriage-maker's clamps
1——10-inch screwdriver
1——8-inch bit brace (ratchet brace preferred)
1——bit gage
1——set of auger bits, 13 in all, as follows: $\frac{1}{4}''$, $\frac{5}{16}''$, $\frac{3}{8}''$, $\frac{7}{16}''$, $\frac{1}{2}''$, $\frac{9}{16}''$, $\frac{5}{8}''$, $\frac{11}{16}''$, $\frac{3}{4}''$, $\frac{13}{16}''$, $\frac{7}{8}''$, $\frac{15}{16}''$, and $1''$.
1——expansive bit for large holes
4——twist drills for wood as follows: $\frac{1}{8}''$, $\frac{5}{32}''$, $\frac{3}{16}''$, and $\frac{7}{32}''$.
1——counter-sink (for screw heads)

Making Seed Boxes and Bird Houses

Now let us make the seed germinating box, Plate IV, Plan 7. Cut out the stock in the usual manner except that the ends of the pieces should be cut in the miter box, Figs. 16 and 17. This will enable you to be very accurate—a prime necessity in all the coming projects. If this box is to be painted, which, of course, it should be, smooth the sides of the pieces very lightly with the smoothing plane, Fig. 18, and sandpaper with No. 1 sandpaper, Fig. 19. Nail the side on with finishing nails and set the heads a bit below the surface with the nail set. Fill the holes, after the first coat of paint is dry, with putty.

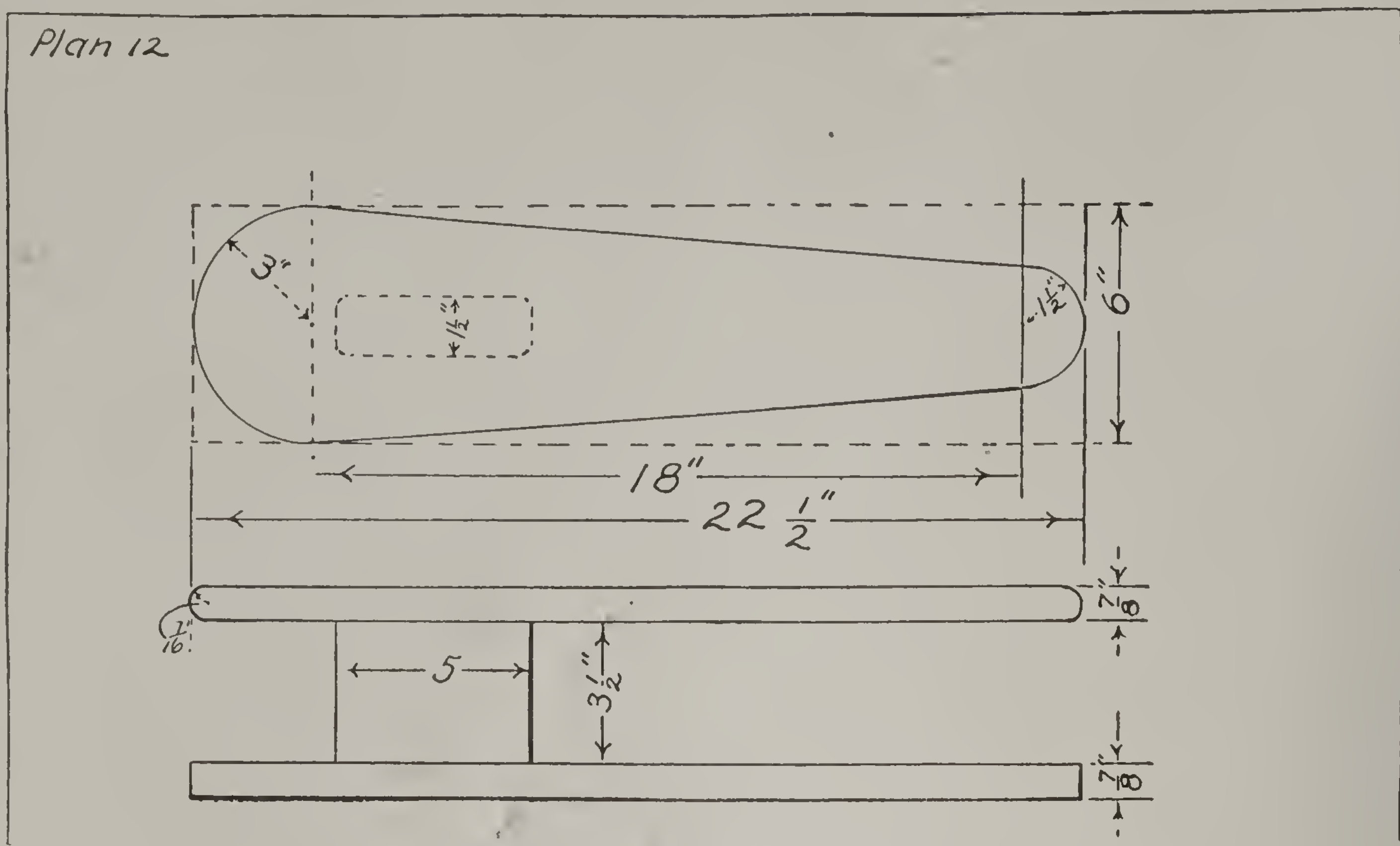
Fig. 16 and Fig. 17. Use of Miter Box and Saw



These two pictures explain fully the use of the miter box and saw. In Fig. 16 a square cut is being made while Fig. 17 shows the method of making a "miter" cut. Note the iron clamp. This is a good way to hold large work firmly in the box for cutting.
You will find this tool one of the most useful of all.

You will find that building a box that is correct to dimensions and square is no "snap." Perseverance and carefulness will, however, win success. This form of box may be adapted by varying the dimensions for almost any purpose for which an open box may be needed.

For the little bird house in Plan 8, cut out the two side boards in one piece, lay out the slanting edge, and



PLAN 12. SLEEVE BOARD
Stock list, whitewood or pine

	Inches
2 pieces	⅞ x 6 x 22½
1 piece	1½ x 3½ x 5

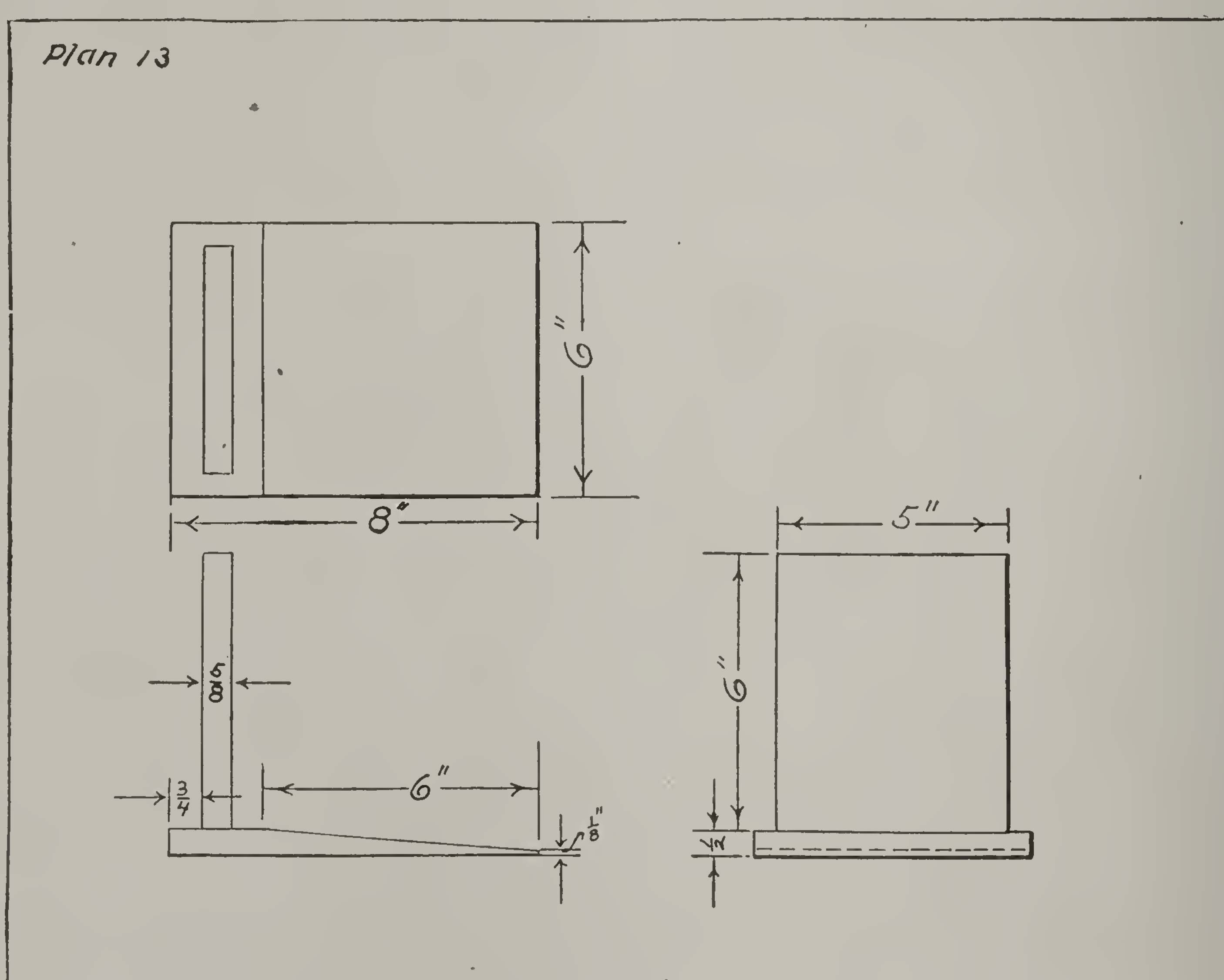


Plate VI

PLAN 13. BOOK HOLDER
Stock list, oak or chestnut

	Inches
Base, 1 piece	½ x 6 x 8
End, 1 piece	⅝ x 5 x 6

make the cut in the miter box, Fig. 17. *Wherever a piece is the hypotenuse of a right triangle, the horizontal base of the triangle is called the run and the vertical side is the*

Fig. 18. Smooth Planing

This boy is using the smoothing plane to smooth the side of a board. Notice the "shearing cut," the manner of holding the work between the tail vise and a bench peg, the position of his hands, and the fine curly nature of the shavings that indicates a thin cut.

Fig. 19. Sandpapering

Sandpaper varies in coarseness from 00 to No. 2. The grade is marked on each sheet. Never sandpaper until all tool work is done, for the grit of the sandpaper will dull the tools. You will find 0 and ½ the best grades for most work. Tear each sheet over the sharp edge of the bench or piece of work through the center lengthwise and crosswise. Fold the pieces thus made once and use them wrapped around a small block as shown. Work lengthwise the grain, and be careful not to sandpaper the work out of shape. Shape your work with tools, smooth it with the sandpaper. Notice the position of the plane lying on the back of the bench. When not in use, planes should be laid back in this position, thus protecting both the bench top and the edge of the plane blade.

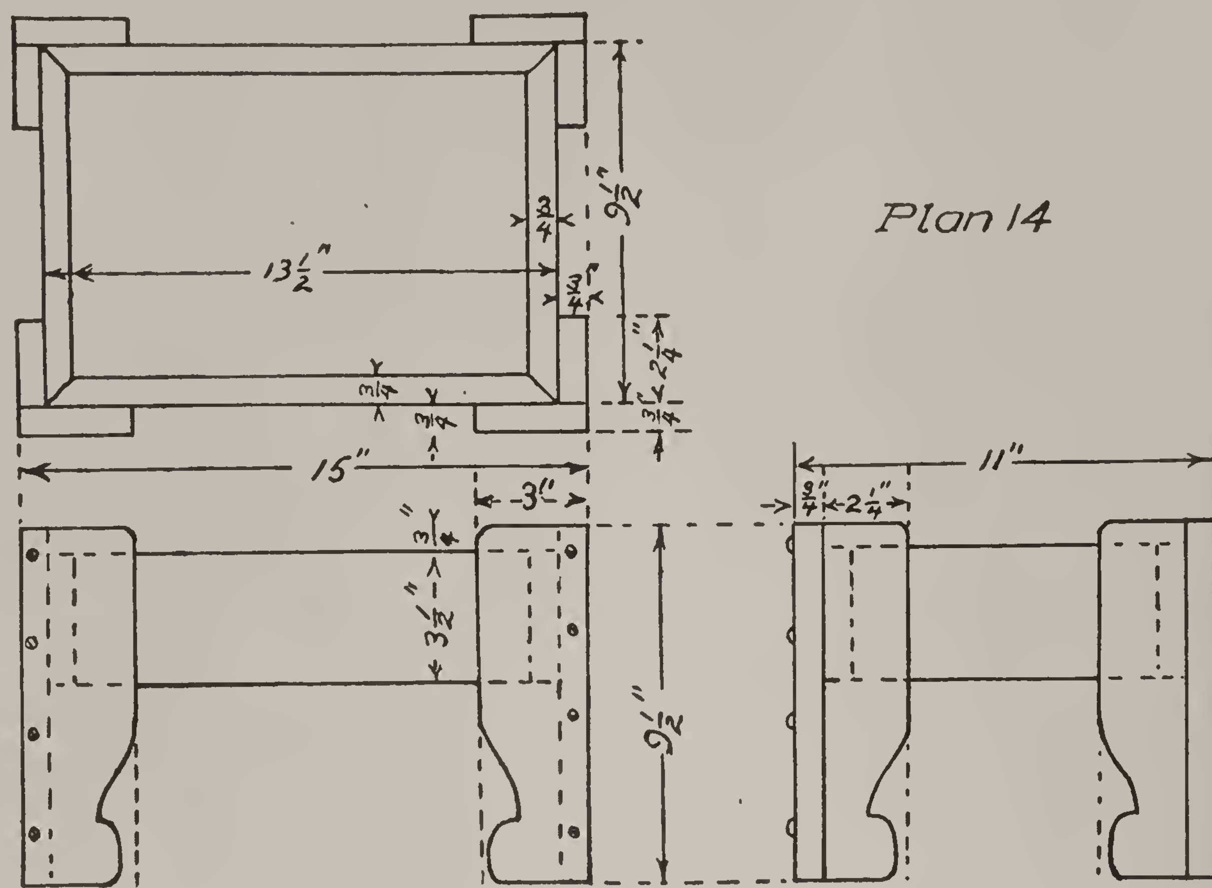
Fig. 20. Boring with the Auger Bit

There are two ways of holding a bit and brace. This is the horizontal position and permits of greater pressure being used, as is sometimes necessary in hard wood. In soft wood the spur will draw the bit in without any additional help. Try to bore straight through; it will require some experience.

If the bit is forced entirely through from one side, it will make an ugly split on the back. To avoid this, bore until the bit pricks through, then turn the board around and finish the hole from the other side.

Twist drills for wood are used in about the same manner, except that it it unnecessary to reverse the work to prevent splitting.

In laying out work for boring holes, locate the centers.



Plan 14

Plate VII

PLAN 14. FOOTSTOOL

COMBINATION

WHISK BROOM HOLDER and NECKTIE RACK

Scale, 6" = 1'

STOCK LIST		Basswood
Back	1	$\frac{3}{8} \times 5 \times 8$
Guides - -	2	$\frac{1}{2} \times 1\frac{3}{8} \times 4\frac{3}{4}$
Rail - - - - -	1	$\frac{3}{8} \times 1 \times 14$
Cross Bar	1	$\frac{3}{8} \times 1\frac{1}{4} \times 5$
Template .	1	$\frac{3}{8} \times 4\frac{1}{2} \times 5$

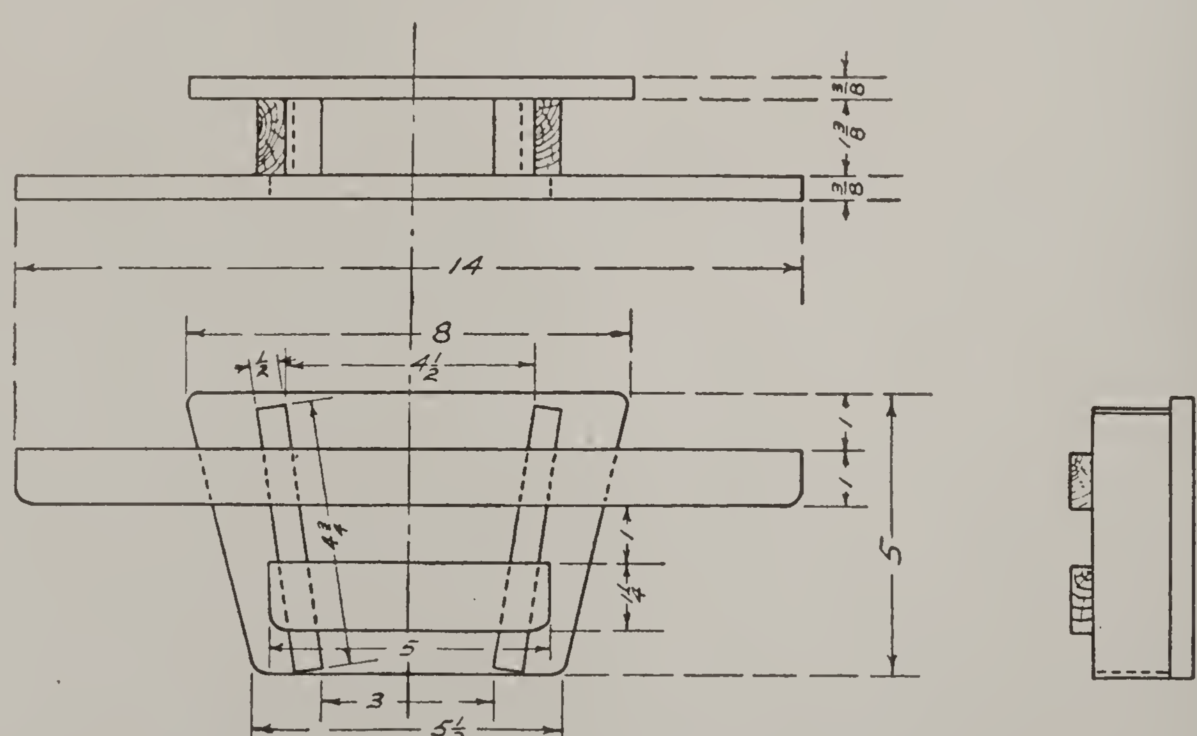


Plate VIII

PLAN 15. COMBINATION WHISK BROOM HOLDER AND NECKTIE RACK

rise. Instead of the opening left above the front board, the front may be all closed up and a hole bored

Fig. 21. Setting Screws

This boy is setting screws. Notice the position of the forearm, the hand, and the screwdriver.
Never try to force screws in without having first made the holes for them. Either you will twist them off if the wood is hard, or you will split the wood if near the end and the wood is soft.
Flat-head screws should have the holes countersunk so the heads will be even with the surface when they are driven home.
The tip of a screwdriver should be kept square and the sides flat. Never sharpen down a large driver to fit a small screw. The slanting sides thus made will slip out of the kerf in the screw-head and the driver will be practically useless.

with the expansive bit for the door. (See boxing with the augur bit, Fig. 20.)

Making Workshop Equipment

Plans 9, 10, and 11, in Plate V, are for workshop equipment. The bench hook is to hold work and protect the bench top. Its construction introduces you to the setting of screws. Screws should be much more carefully located than are nails. First, with a drill as large as the screw (in diameter), bore a hole through the top piece; with the countersink, fit this hole to the screw head. This applies only to flat head screws; round head screws are never countersunk. The screw should go into the second place about one-third its length. In hard wood, a hole should be made the full depth with a drill that is about the size of the

Fig. 22. Mallet and Chisel

A large part of work with a chisel may be done with the "paring" cut, holding the handle in the palm of the right hand and guiding the tool with the left. Round corners are cut with the flat side of the chisel down; for hollows use the bevel down. Take small cuts.
For heavy work drive the chisel with a mallet; never use a hammer, as it spoils the chisel handle. This boy is making a half joint or a notch, as for the tool rack. His work is laid out on both sides of the stock. He will work to the line, first on one side, then on the other. Observe the bench hook under the work to protect the bench top.

screw at the bottom of the threads. With the two pieces firmly held together in vise or with clamps, drive the screws "home" with the screw-

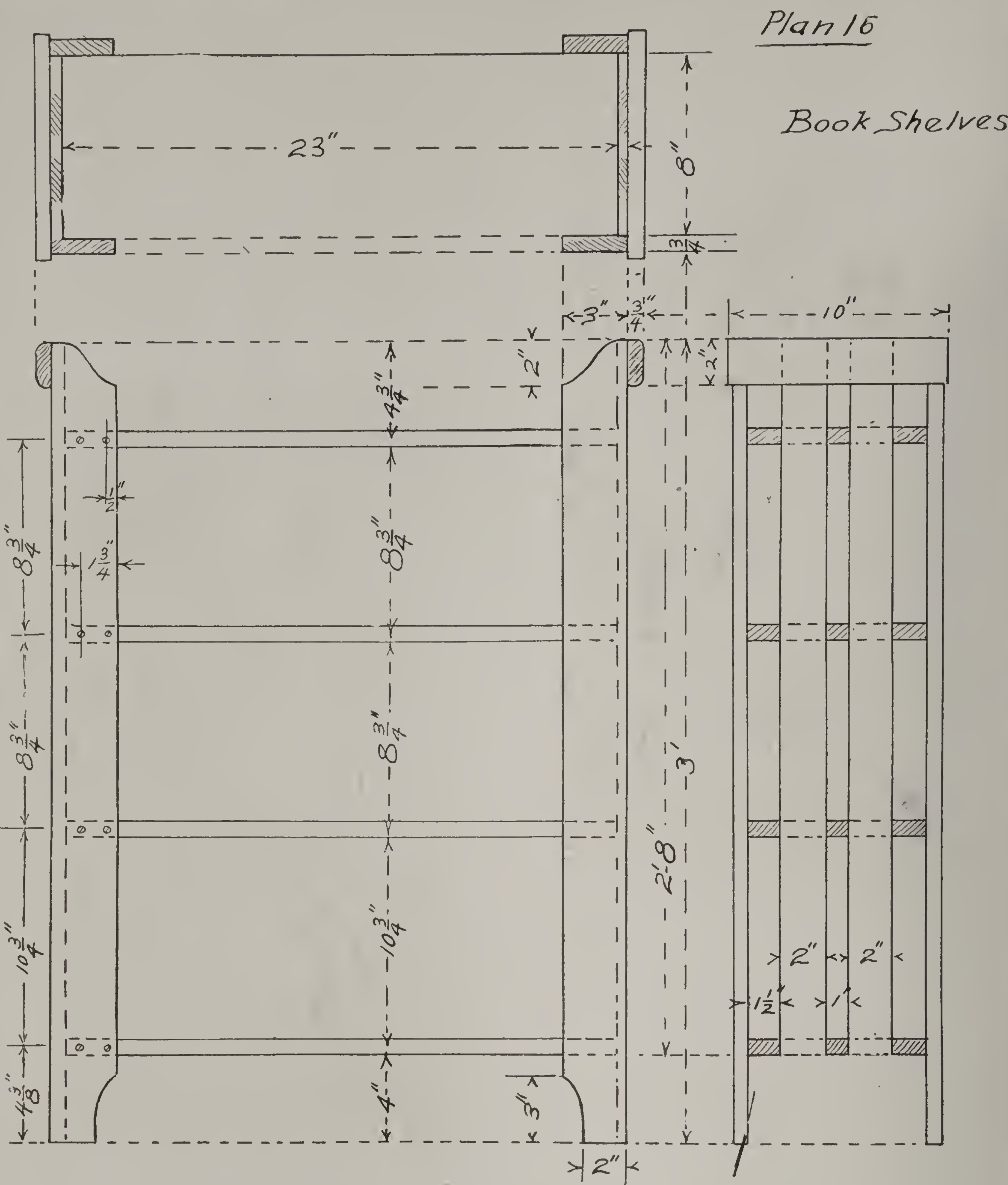


Plate IX

PLAN 16. BOOK SHELVES

Stock list, chestnut or whitewood

	Inches
Shelves, 4 pieces	¾ x 8 x 8
Posts, 4 pieces	¾ x 3 x 36
Slats, 4 pieces	½ x 2 x 32
Top bars, 2 pieces	¾ x 2 x 10

driver, Fig. 21. Bore the hole after the pieces are fastened together.

The legs to the saw trestle present the rafter problem, Fig. 15. Note that the run is 8½ inches and the rise is 18 inches, and that these are laid out on a line one-half inch from the edge of the stock. Make the cuts

in the miter box. Nail the stock together securely with common nails. Cut the brace boards across the ends after they are nailed in place.

Fig. 23. Filing

Notice carefully the manner of holding the file. Take each stroke from you, removing the file for the back or return stroke. The surfaces of files are made up of tiny teeth that cut with the forward stroke only, drawing the file backwards dulls them. Use the flat side of the file around projecting curves like the corner of the board in the picture. For hollows, use the round side. Test your work frequently with the try square. It requires careful work to shape curves well with a file. Do as little filing as possible; work should be cut as nearly as possible to the right shape with the more accurate tools.

The tool rack is given as a suggestion only. Very likely you will need one of very different dimensions. Arrange the notches along the back to fit the tools. Lay them out carefully with square and gage, saw the sides with the miter box, and chisel out the hole as shown in Fig. 22.

The sleeve board in Plate VI, Plan 12, should be securely fastened together by two 1½-inch screws through both top and bottom boards. Cut out the ends with the compass or pad saw. Work the top to all the lines accurately with the edges square; then, ⅜-inch from the edge, draw a pencil line on both sides and, with spoke shave, file, and sandpaper, Fig. 23, try to make the edge a perfect half circle. Lay this board out from the center line; your wing compasses will be needed for the circles.

Fig. 24. Using the Drawshave

Notice that the drawshave is held with the flat side to the work. Turn it a bit at an angle so as to obtain a "shearing" cut. You have undoubtedly learned long ago when whittling with your pocketknife that a shearing or drawing cut is the easiest made and gives the smoothest surface. Remember this principle in using any edge tool.

The drawshave is a convenient tool for quickly disposing of heavy cuts of waste, as in outline to the side lines of the tapering sleeve board in Plan 12.

Making a Book Holder

The vertical end of the book holder, Plate VI, Plan 13, should be fastened to the baseboard by three screws up through from the underside. As these screws go into the

end grain, they must be at least 1¼ inches long and rather small in diameter, and very carefully set, for screws, like nails, do not hold well in end-grain. Modify the shape of the end boards to any outline you may desire. Be sure that this job is nice-

put on a light coat of wax, spreading it with a bit of cloth. As soon as it begins to feel "rubbery," polish with a clean cloth. Be sure when you are through to burn all cloths used for this work, as such cloths will, in time, heat and catch fire spontane-

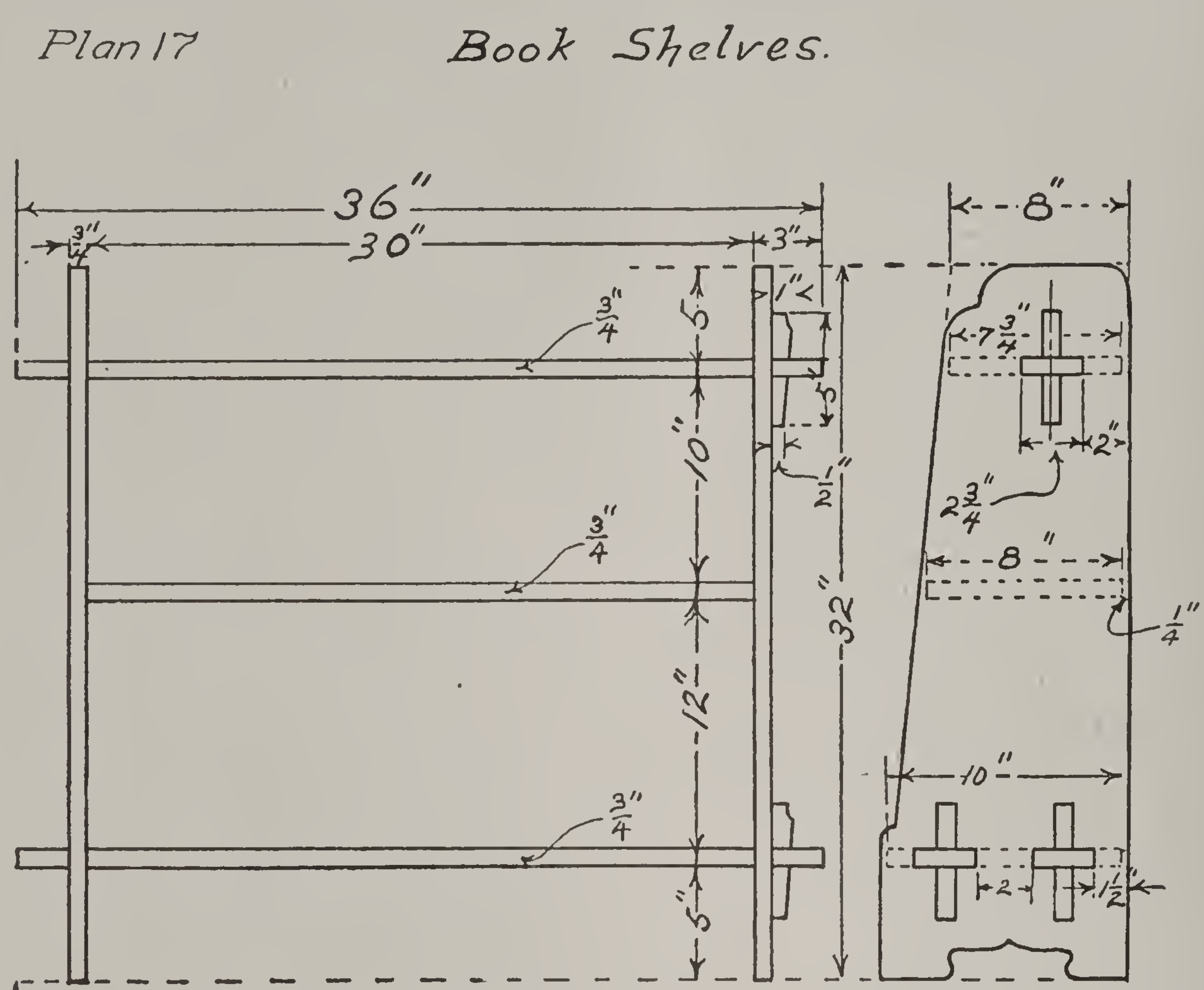


Plate X

PLAN 17. BOOK SHELVES

Stock list, oak, chestnut or whitewood

	Inches
Top shelf, 1 piece	¾ x 8 x 36
Middle shelf, 1 piece	¾ x 8 x 30
Bottom shelf, 1 piece	¾ x 10 x 36
Ends, 2 pieces	¾ x 11 x 42
Wedges, 6 pieces	¾ x 1 x 5

ly smoothed up, Fig. 23, for it is the first piece of furniture you have tried. Get a small can of wood stain (do not get varnish stain) and

The Art of a Real Artist

a small can of furniture wax. With a small brush stain the book holder all over except the bottom. As soon as the stain begins to look dull, wipe off all that you can with an old cloth. In about a half day's time

ously. Get a can of liquid glue and spread a thin, even coat on the bottom with a thin stick and cover it with a piece of felt somewhat larger in size, so that when the glue dries the felt may be trimmed even with the shears. It is a good plan to cover the bottom of any article intended to be used on a table top with felt to prevent scratching and to give a neat appearance.

This Is for Mother

How to Make a Foot Stool

The details for the frame of a footstool that is intended for simple upholstering are given in Plate VII, Plan 14. The design at the bottom of the posts may be varied to suit your ideas. Cut whatever outline you decide to use from a strip of heavy paper and use it as a pattern. After all the pieces are cut to size and nicely smoothed, first, fasten the two parts of each post together with round-head, blue screws; then fasten the rails on the inside of the posts with two flat-head screws in each end of each rail. Nail a piece of leather or other suitable upholstering material on the top of the frame with the edges neatly folded under. Use fancy upholstering nails, taking pains to space them evenly. Turn the stool top down, pack in as much as the frame will easily hold of curled hair (fine excelsior will do as a substitute), fit a ½-inch pine board loosely inside the frame and fasten it in place with a cleat fastened along the lower edge of each end rail. Finish the stool as explained for the book holder, Plate VI, Plan 13.

The only difficult thing in Plate VIII, Plan 15, is the assembling. In doing this, work from the center line. Notice the stock list calls for a template—this is a block to fit between the guides. Fasten it temporarily in place on the back, then fasten the guides securely and remove the template. Use flat-head screws for the back and round-head screws for the front. Finish nicely with stain and wax. If you have mastered all previous

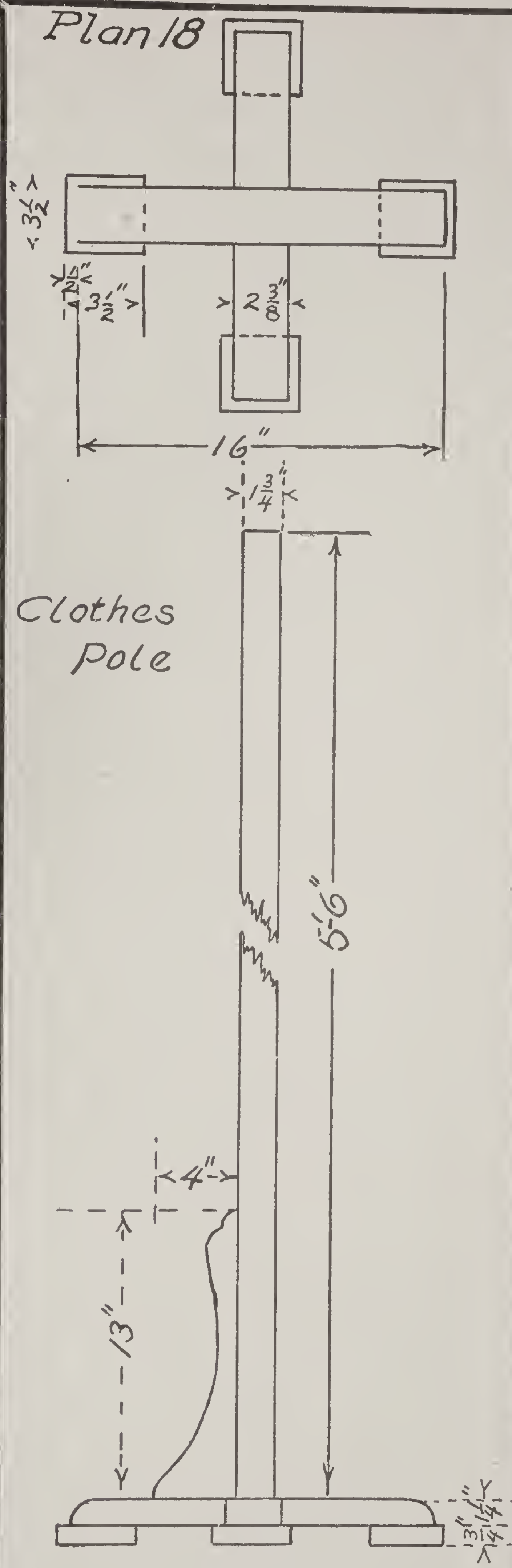


Plate XI

Plan 18. Clothes Pole.

Stock list, whitewood, chestnut or oak

Pole, 1 piece	1¾ x 1¾ x 5′ 6″
Braces, 4 pieces	¾ x 4 x 13
Base, 2 pieces	1¼ x 2⅜ x 16
Feet, 4 pieces	¾ x 3½ x 3½

work, the set of shelves Plate IX, Plan 16, will present no great difficulties. Note the details given on the left post for the location of the screws; these are, of course, the same for all four posts. Lay out these dimensions very carefully. The holes must be made in both the posts and in the edges of the shelves as well, otherwise the shelves cannot be properly placed and will be split by the screws. Fasten the top bars to the posts with screws; the slats may be fastened with finishing nails and their heads covered with small fancy upholsterer's nails. Finish the shelves with stain and wax.

Plate X, Plan 17, is a more difficult style of bookshelves. Holes, called *mortises,* are cut through the ends to receive projections or tenons on the ends of the top and bottom shelves. Holes are in turn cut in these tenons to receive the tapering pins and, when driven in place, hold the whole piece firmly together. The middle shelf is held up by pins, called *dowels,* (see note under Fig. 25), inserted in the end of the shelf, holes being bored in the end boards to receive them. Lay out the work very carefully on both sides of the stock. Cut first the tenons; then the mortises through them for the pins. Be sure these are so located that the pins will tighten. In cutting the mortises, bore out as much as possible with an auger bit, then finish with a mallet and chisel. Work partly from both sides of the stock or you will split and spoil the work.

More Homes for Book Friends

In the drawing of the clothes pole, Plate XI, Plan 18, for the sake of clearness some of the details have been omitted. The two parts of the base are crossed and at their center a "half joint" is made. This is just like the joint described in Plate III, Plan 6, for the corner of the kennel frames. Fasten the parts of these shelves securely with flat-head screws from the underside of the base. Put on the braces last and fasten them to the pole with finishing nails set and puttied, or with round-head screws.

Fig. 25. Boring for Dowels

This boy is doing several things to take note of. First, he is using the vertical position for boring with bit and brace. Second, he has a bit gage on his bit which enables him to bore several holes all of the same known depth, and he is preparing to fasten two pieces of stock together with dowels and glue to make a wide piece for a taboret top.

Doweling is a round wooden rod obtained in ¼", ⅜", and ½". Three-eighth inch is more commonly used. In putting table tops and similar work together, short pieces about 2" long are used in the joints. First, make the joint using the longest plane you have, so that it will be perfect when the two edges are laid together. Then fasten together in the vise, as in the picture. Square lines across the edges, find exact center of each board on these lines, and bore holes to fit dowels about ⅛" deeper than half the length of dowel. Insert dowels in one board with glue. Put glue in the other holes and on entire surface of joint, and clamp together with bar clamps. Be sure piece is perfectly flat and leave 24 hours to dry.

Use of the Turning and Coping Saws

For cutting the curves in the braces at the foot of the clothes pole use the turning saw, Fig. 26. The compass saw or pad saw may be used, but once the turning saw is learned you will prefer it to the others. The more gradual curves may be smoothed with the spoke shave, which is adjusted much like the block plane of which it might be called a distant relative Tip the tool forward on its nose, set it for a very light cut, use a shearing stroke and, above all, work with the grain. Be as careful to keep curved edges square with the sides of stock as you are to keep straight edges square. All sharp curves must be filed. Smoothing must be finished by wrapping sandpaper around the file. The foregoing directions will apply to all curved edges.

Fig. 26. How to Use the Turning Saw

The thinness of this saw together with the wide space between the blade and the brace enable you to cut in a circle or turn just as sharp curves as you find it necessary in cutting any piece of wood.

The coping saw is used for very abrupt curves and for thin stock. It may be used to make dissected picture puzzles. For these, use pulp board ¼ inch thick (often used for interior wall covering in house building). Paste any suitable picture smoothly on this stock, cut to the edges of the picture with the cross-cut saw, smooth the edges with the plane, and then saw into any irregular pieces you may choose with the coping saw. Hold the work on one corner of a bench or table and run the saw in a vertical position. A small clamp will be of use in holding the work firmly.

Making Plans of Your Own

Having reached this point in your work with tools, you will be able to make many simple articles that you may find need for, planning them to suit your own special purposes. You will find this even more interesting than following ready-made plans. Often the best way is to work from a model of the desired article, making such changes in dimensions and construction as will better adapt it to your own peculiar use. The following are suggestions.

Sawing Out Weather Vanes

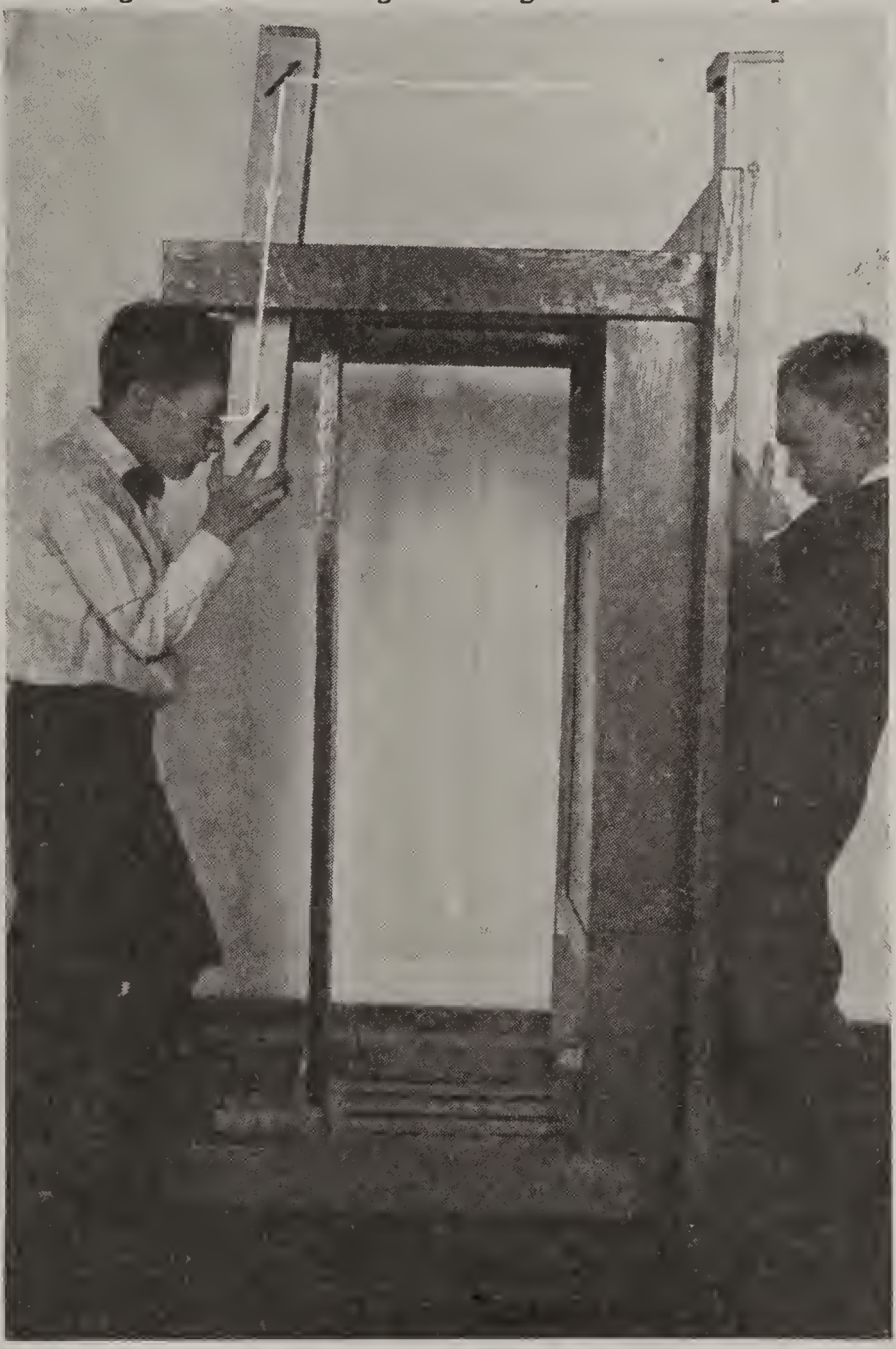
Weather vanes in interesting variety may be made by cutting figures of birds or animals from thin wood with the coping saw. Fasten these to a heavier bar or horizontal base strip through which a hole is bored to receive a vertical pin upon which the vane is to revolve. To make the vane "face the wind," this hole must be nearer the front end of the vane. The pin may be a large nail or "spike" driven in the top of

a post. Place a washer between the vane and the post to allow the vane to turn easily.

Windwheels are mounted in the same manner as are weather vanes. The wheel may be made by half-jointing two soft wood pieces (joint used in base of clothes pole, Plate XI, Plan 18) at their centers, then whittling or drawshaving the four arms all to the same slant. Small wheels, whose arms have rather sharply slanting faces, turn the more easily and run the faster. A good wheel may be made by using a round block of wood, perhaps ¾ inch thick by 2 inches or more in diameter, for a hub on which pieces of tin, properly bent, are fastened for arms. Make the body of the model of a piece an inch or more square in cross-section and about as long as the diameter of the wheel. To one end of the body the wheel is attached so as to revolve freely, and the other end is provided with a suitable vane or "tail" of thin wood sufficiently large to compel the model to "face the wind." Find, by trial, the point on which the assembled model will balance and through the body at this point bore the hole to receive the vertical pin on which the model is to turn.

Then Try a Wind Wheel

Fig. 27. Looking Through the Periscope



Here are two periscopes that these boys made for themselves. They are made on the same principles as the ones used by soldiers in a war. The picture shows how the mirrors should be set. Make one and you will have something new next time you are playing soldier or having a snow-ball battle.

A level and a compass are necessary instruments in constructing a sun dial. The face of the sun dial must be a perfectly level surface, preferably square, on which a line, called the *noon mark*, has been drawn running exactly north and south. The finger of the dial, called the *gnomen*, is set on this noon mark; the upper edge of the gnomen must be parallel with the earth's axis. To occupy this position it must make an angle with face of the dial that is equal, in number of degrees, to the local latitude. Having the dial with its gnomen correctly set, the hour marks

may easily be established on any sunny day.

All out-of-door articles that are intended to resist the weather should be given at least three coats of "outside" paint.

Where a Wash Boiler Is Useful

Making Skis and Toboggans

Skis and toboggans are simple yet rather difficult projects. The difficulty lies in the bending of the wood. To do this rightly a "form" must be made, the wood being steamed until pliable and then clamped or otherwise fastened to the form until perfectly dry. The steaming will very likely prove a hard problem, but it may be done in a wash boiler, over which a canvas cover has been tied in such a manner as to hold the wood in place. The process will take several hours. It will quite likely be necessary to have your forms made at some local shop.

Before undertaking skis or toboggans, you should make a careful study of some good model. Select the best straight-grained white ash, if possible to secure it. Probably the next best wood is spruce.

Hockey sticks may be cut from birch or white maple and bent in like manner. Give such models as these three coats of good wagon or boat varnish.

Stilts? That's an "Easy One"

Stilts are very easily made. Be sure to have strong straight wood for the long pieces; their size and length will depend upon the size and weight of the boy who is to use them. Bevel or round off the corners of these pieces and make them very smooth. Make the foot pieces the right width at the top to receive your foot; eight inches would be a good length, and they should be tapered or curved away so that the width at the bottom will be about an inch. Attach them at whatever height you like and secure them with carriage bolts, two in each, passing entirely through both the foot piece and the pole. A broad leather strap should be so fastened (nailed) as to fit the top of the foot to hold it in place and to help in raising the stilt in walking.

How to Make a Periscope

The boys in the picture, Fig. 27, are looking at each other over the end of this big table through periscopes. These are the instruments used by the submarine and by the soldier in the trenches to see the enemy, without exposing himself. The "scopes" these boys have made are long hollow boxes about 2½"x4" on the inside, constructed of ⅜-inch stock. Near each end, but on opposite sides, small holes—about 1"×3"—are made to look through, and facing these holes small mirrors are built in at an angle of 45 degrees. The black lines drawn on the periscope at the left will show the position of these mirrors and the white lines will explain how the boy, by looking through the opening in the bottom of his instrument, can see the top of the one the other boy is using.

When Kite Time Comes

Kite-making is a craft in itself. The kite is really the most elementary form of the modern aeroplane. The most common and perhaps the best kite is the tailless kind. This kite may be made any desired size. For its construction you will need two sticks, the *spine* and the *bow,* both of the same length. Basswood makes good kite sticks, being both light and flexible. The size of the stick in cross-section depends, of course,

upon the size of the kite or upon the needed strength. Use the lightest sticks possible and secure rigidity of construction. ¼″×½″ will be found a suitable dimension for use in medium-sized kites. Kite sticks should be lashed together, not nailed. V-shaped grooves should be cut across the ends to receive the stringing, and the sticks should be neatly wound with small cord near the ends to prevent splitting. All lashings and windings should be secured with a coat of shellac.

Suppose we have decided to build a tailless kite with a 3-foot spine. Lash the bow to the spine at the center of the former and about one-fifth the length of the latter from the end. Next, string around the frame thus made hard twisted cotton cord that will not stretch, using care to have the frame perfectly balanced and spaced. The covering to this kite must be put on loosely or the kite will be unsteady and likely to dive to destruction. Lay the strung form on a sheet of strong tissue paper and cut the covering 2 inches outside of the strings. Use about ¾ inch of this extra size to fold and paste around the strings. Stretch a cord tightly from end to end of the bow. Between this cord and the bow at their centers, insert a brace stick about 3 inches long. The bridle is a cord fastened to the two ends of the spine and it should be long enough so that, when pulled to one side, it will reach the end of the bow. It is at this point in the bridle that the kite line is attached.

Fig. 28. A Miniature Telegraph System

The above telegraph system can be made up of the materials that nearly every boy can find at home, with the exception of the copper wire which can be secured at a hardware store, or from a dealer in electrical supplies. You can see from this, how to make the wet cell from an old dry cell and glass fruit jar, and how to arrange the instruments and make the connections.

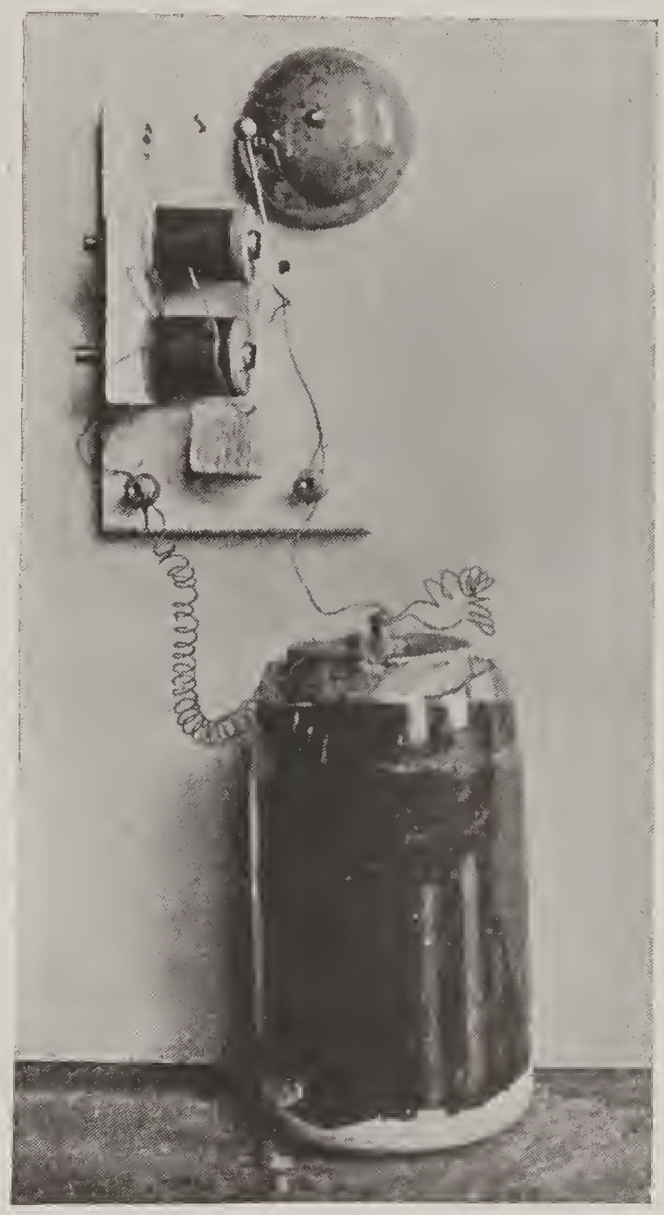
The Square Box Kite

The square-box kite requires a stronger wind but has greater pulling qualities and is steadier than are its flat relatives. It is not difficult to make, if care and accuracy are used. Fourteen inches square is a good size to choose. The *cell* at each end should be as long as the kite is square, and the *vent* between the cells somewhat longer—perhaps 17 inches for a 14-inch kite. First get out four corner sticks the right length. Six inches from each end

of each stick on one edge cut a square notch ⅛ inch deep to receive the ends of the brace sticks, two of which are placed diagonally in each cell. These brace sticks should be square notched at each end to fit the notches in the corner sticks, wound to prevent splitting, and made just long enough to bow slightly when in place. To ascertain the length of the brace sticks, lay out a 14-inch square. Draw its diagonals. From the length of these diagonals subtract the combined width of the two corner sticks, then add for the notches in both corner sticks and in both ends of the brace stick.

Make the covering of the cells of two strips of thin, tough paper, 58 inches long by 15½ inches wide. Fold over ¾ inch along both long edges. Lay a small cord in the crease and glue down the fold. Lap the ends 2 inches and glue together, making both covers exactly the same length—28 inches when folded flat. These cell covers may be made of cambric if desired. Place glue on the outer edge of two of the corner sticks for a distance of 14 inches from each end and fasten them in the opposite folds of the cell covers. Exactly in the center between this pair of corner sticks the covers should again be folded flat and the other pair of corner sticks glued in place. Open the kite after the glue has dried and insert the brace sticks, which, if their length has been correctly determined, will make the kite rigid. To fly the kite in a diagonal position, use for a bridle a single line fastened to the two ends of one of the corner sticks. If the kite is to fly in a horizontal position, two adjacent corner sticks should be provided with bridle lines which are caught together by the kite line. The length of the bridle lines and the point at which to attach the kite line must be determined by trial, for no two kites can be made to behave exactly alike.

Fig. 29. A Home-made Doorbell



In fact, successful kite-making and flying require a good supply of patience and persistence, and the beginner must not be disheartened by many a defeat.

Making Edison's Playthings

The making of simple electrical devices is very fascinating but requires much special material and often the purchase of quite expensive bits of apparatus. It is, in fact, a special field in itself, related only incidentally to mechanical construction or ability. There are, however, some simple pieces easy to make from readily obtainable material that are both interesting and instructive,

if not exactly of practical value.

First, you will need a source of electricity—a battery. The dry cell of commerce is the most convenient form in which to obtain electrical energy. You can readily obtain these dry cells, after they have become discharged and useless, from any garage or from some of your automobilist friends. These dry cells may easily be made into quite efficient wet batteries.

Making a Wet Battery

First, cut off the top of a quart fruit jar. To do this, soak a piece of cotton twine in alcohol or gasoline and wind it several times around the jar where you desire to cut it off. Set fire to the string. As soon as it has burned out plunge the top of the jar in water. The two parts of the jar will quickly part company.

Remove the pasteboard covering from the dry cell and with a tenpenny nail punch twenty or thirty holes in the sides of the battery. Distribute these holes as evenly as possible. Punch them deeply enough to reach the carbon center but not deeply enough to break it.

Mix a small amount of plaster of paris with water in the bottom of the glass jar, imbed the bottom of the dry cell in the plaster and allow it to harden. Fill the glass jar to within one-half inch of the top of the dry cell with a *saturated solution* of salammoniac. Melted paraffin may be poured over the top of this solution to prevent slopping. One of these batteries is shown in the illustration of the telegraph, Fig. 28, and of the door bell, Fig. 29. It is hardly sufficient to operate these, but several such batteries may be connected in a series and will develop enough current for many uses. They will easily produce one-half volt each, or about one-half the strength of the dry cell when new. In connecting the series, remember that the positive pole of one must be connected with the negative pole of the next (center with rim).

Making an Electromagnet

An electromagnet consists of an iron core around which an insulated wire has been regularly and evenly wound. To make a simple electromagnet, wind a common spool with No. 20 (B & S Gage) insulated wire. In starting the winding, leave enough of the first end of the wire projecting to provide for connecting with the battery or instrument. Fill the spool with the winding, which may be shellacked or covered with bicycle tape. Through the spool insert and fasten a common stove bolt; when the two ends of the winding wire have been connected with the two poles of the battery, your spool has become a magnet, the ends of the bolt being its north and south, or positive and negative, poles respectively.

Two of the simple magnets are usually connected as shown in Fig. 29, when they become a horseshoe magnet. The inner wire of one should be connected to the outer wire of the other and a bar of iron or a heavy wire fastened by the nuts on the bolts across the ends of the two spools. The positive and negative poles are then adjacent, instead of being the opposite ends of the single magnet. The horseshoe magnet may be conveniently mounted on a wooden block. A better magnet may be made if, instead of using the wooden spool, the stove bolt is covered with waxed paper and pasteboard washers are used at

each of the ends. Of course electro-magnets are not magnets except when the current is flowing through them. The more cells you have in your series, the greater the power of your magnet. Polished bits of steel like your knife blade may be temporarily magnetized by drawing them across the poles of the electro-magnet, and interesting experiments may be tried with pins, needles, and other bits of steel and iron.

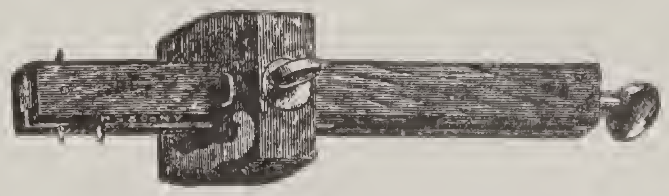
Now the Telegraph

There are many electrical devices that depend for their operation upon the interruption or breaking of the electric current and the use of some form of the electro-magnet. Among these are the telegraph and the electric bell.

Fig. 28 shows a very crude telegraph outfit. At the right is the key or sending instrument. This one is made of a strip of tin, the edges of which were turned over and the whole piece bent as shown, and tacked to the wooden block. A 2-penny common nail is driven through the tin by means of which the key is connected to the positive pole of the battery. A second nail is driven in such a position that when the key is pressed it will come in contact with the head of the nail. This nail is connected to one of the wires of the magnet used in the sounder shown at the left in the illustration.

The wiring is completed by connecting the other wire of the magnet

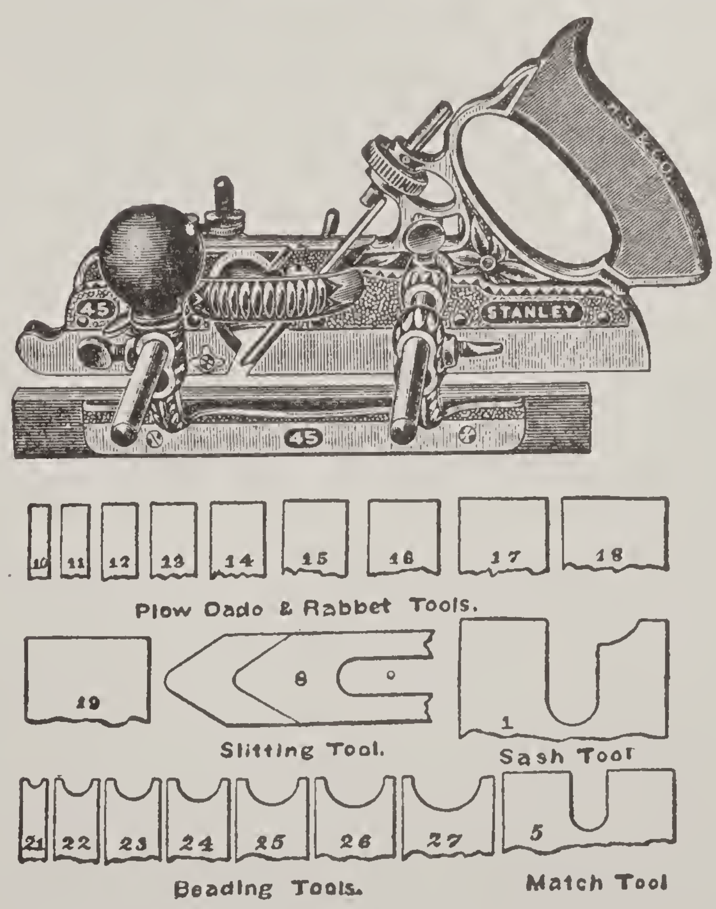
Socket Mortise Chisel



Mortise Gage

Back Saw

Cabinet Scraper



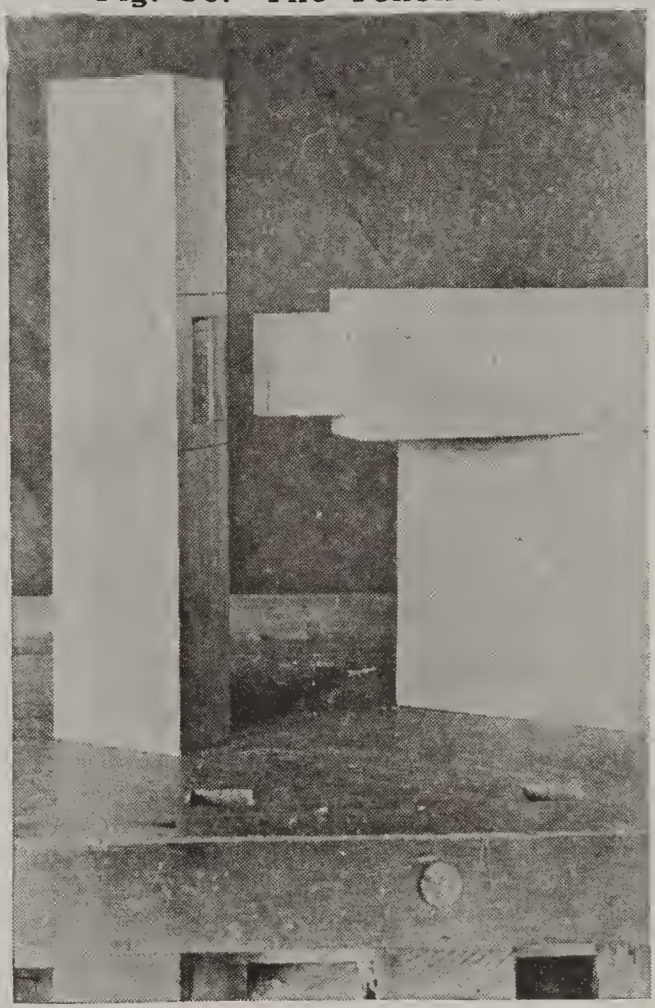
Universal Plane

with the negative pole of the battery. A flexible bit of tin, shaped and mounted as shown in the picture, completes the sounder, as the receiving instrument is called. A very small space is left between this bit of tin and the poles of the magnet. When the key is pressed, the circuit is completed and the magnet is charged and draws the sounder down, holding it until the key is released. In this way, with long and short contacts, the dashes and dots of the telegraphic code may be transmitted, the key being the sending station and the sounder, the receiving station.

How Your Telegraph Works

Plenty of batteries should be provided so as to take care of the resistance, due to the length of an actual line between neighboring houses and to give a strong movement of the sounder. An outfit similar to this will furnish two boys with many of the rudiments of telegraphy.

Fig. 30. The Tenon Joint



This shows the tenon and mortise cut and ready to be put together. In cutting your material to make this joint you must do your marking and cutting very carefully in order to make a close-fitting joint.

Then Try an Electric Bell

The illustration, Fig. 29, shows a crude but working model of an electric bell. The whole arrangement is made quite clear by the photograph except in one particular. Remember that the bell depends for its operation upon a rapid automatic making and breaking of the circuit; then trace the wiring from the battery to the lever that operates the hammer. When this lever is touching the bent nail contact post that shows beneath the bell, the circuit is made and the magnet immediately acts by drawing the lever over to its poles and away from the bell. The lever is made of two strips of tin, the smaller one of which the picture does not show. This strip remains in contact with the post until the hammer lever is almost in contact with the magnet, when, for a brief instant, it leaves the post, and the circuit is broken and the lever springs back, delivering the blow to the bell and again closing the circuit for another working cycle. The smaller strip of tin might be a fine wire, for it needs to be so light that it will not interfere with the spring action of the hammer. The construction of the model would be improved if the bell were placed at the left of the hammer. You will need some patience, a carefully made magnet, and effective batteries if you make a successful bell.

For use in some of the foregoing work and for any "tinker jobs" you will naturally want to try "on your own hook," you will find a pair of side-cutting pliers, a pair of small straight snips, (tin shears) and a

"hack saw" for cutting metal, very convenient tools to own.

Work with Mortise and Tenon Joint

We will end this excursion into the land of "making and doing" with some pieces of work the construction of which requires the mortise and tenon joint. This joint is one of the most difficult to make but when the job of making it is done neatly and well you can feel well repaid for your labor. At this point you will need to get a few additional tools. They are as follows:

3—socket mortise chisels, ¼-in., ⅜-in., ½-in.
1—mortise gage.
1—10-in., 10-point back saw.
1—cabinet scraper with burnisher for sharpening same.

Fig. 31. Manner of Holding Mortise and Tenon Joints

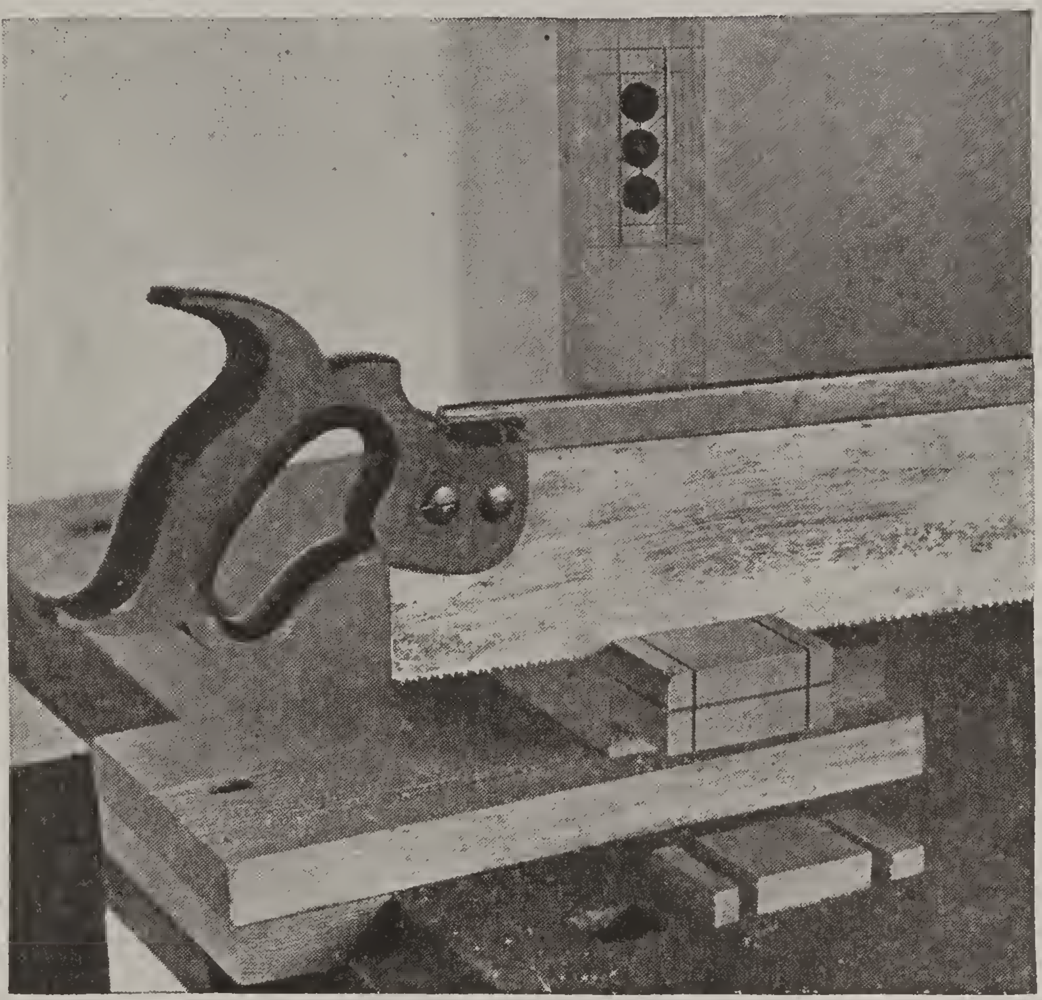
Fig. 32. Sawing Out the Tenon

If you desire to undertake panel work or the construction of drawers or any work requiring grooves, tongues or "rabbets" (consult your dictionary), you will need a universal plane which is provided with interchangeable blades and suitable adjustments for doing all kinds of tongueing, grooving, and rabbeting. This plane will have with it a little book of directions that will explain its use quite clearly.

The mortise and tenon joint, Fig. 30, consists of a mortise cut in the side of one member, into which fits a tenon cut on the end of the other member of the joint. We will speak of these two as the mortise member and the tenon member. Both the mortise and the tenon are usually

centered on the width or the thickness of the stock, the width of the mortise or thickness of the tenon depending usually on the thickness of the tenon member. Stock less than ⅝-inch thick will have ¼-inch tenons, ⅝ inch to ⅞ inch will have ⅜-inch tenons, and stock above ⅞ inch will have ½-inch tenons. This provides for a shoulder on both sides of the tenon, and a still greater shoulder is usually allowed at each end of the tenon. One-quarter inch is a good size for these unless the mortise is very close to the end of its member, as at the top of a table post, when a greater shoulder is allowed to prevent splitting the top of the post.

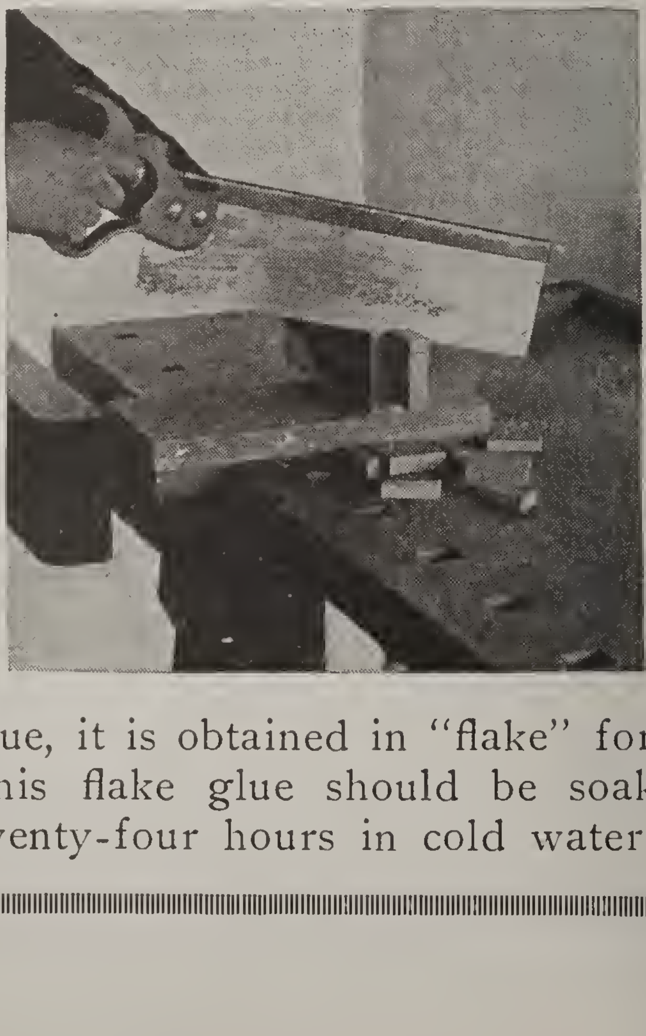
Fig. 33. Cutting the Shoulder for the Tenon



Occasionally thin stock is mortised in full size—for example, the slats in the end of a table or in the back of a chair—but this is not done where the members must be depended upon for structural strength. Besides, it is not nearly so easy to make a perfect joint as with a shouldered tenon. The tenon should be an easy driving fit for the mortise, the latter being made slightly deeper than the length of the tenon. For most furniture making such as we will undertake, tenons should be made from 1 inch to 1¼ inches long.

After joints are properly fitted, apply a thin coat of thin hot glue all over both members and draw the work firmly together with bar clamps as shown in Fig. 31. Be sure that the work is square and correctly assembled and all joints tight. Leave it twenty-four to thirty-six hours to dry before removing surplus glue and smoothing up. Speaking of hot glue, it is obtained in "flake" form. This flake glue should be soaked twenty-four hours in cold water to

Fig. 34. Finishing the Tenon



soften it, then it should be cooked in a double boiler (glue pot).

Glue will not hold joints in articles intended for out-of-doors use. Such joints should be pinned, i.e., after they are drawn together, a hole should be bored through both the mortise member and the tenon about ½ inch from the shoulder and a tightly fitting pin or dowel driven in, its ends afterward being trimmed even with the surface of the mortise member. It is not a bad plan to do this with glued joints for it makes them less liable to be broken by sudden blows.

Figs. 32, 33, and 34 will show quite clearly how to proceed in making a mortise and tenon joint. Having determined the thickness of the tenon and the size of its end shoulders, lay out both mortise and tenon carefully, being sure that they correspond in dimensions and that the mortise is properly located.

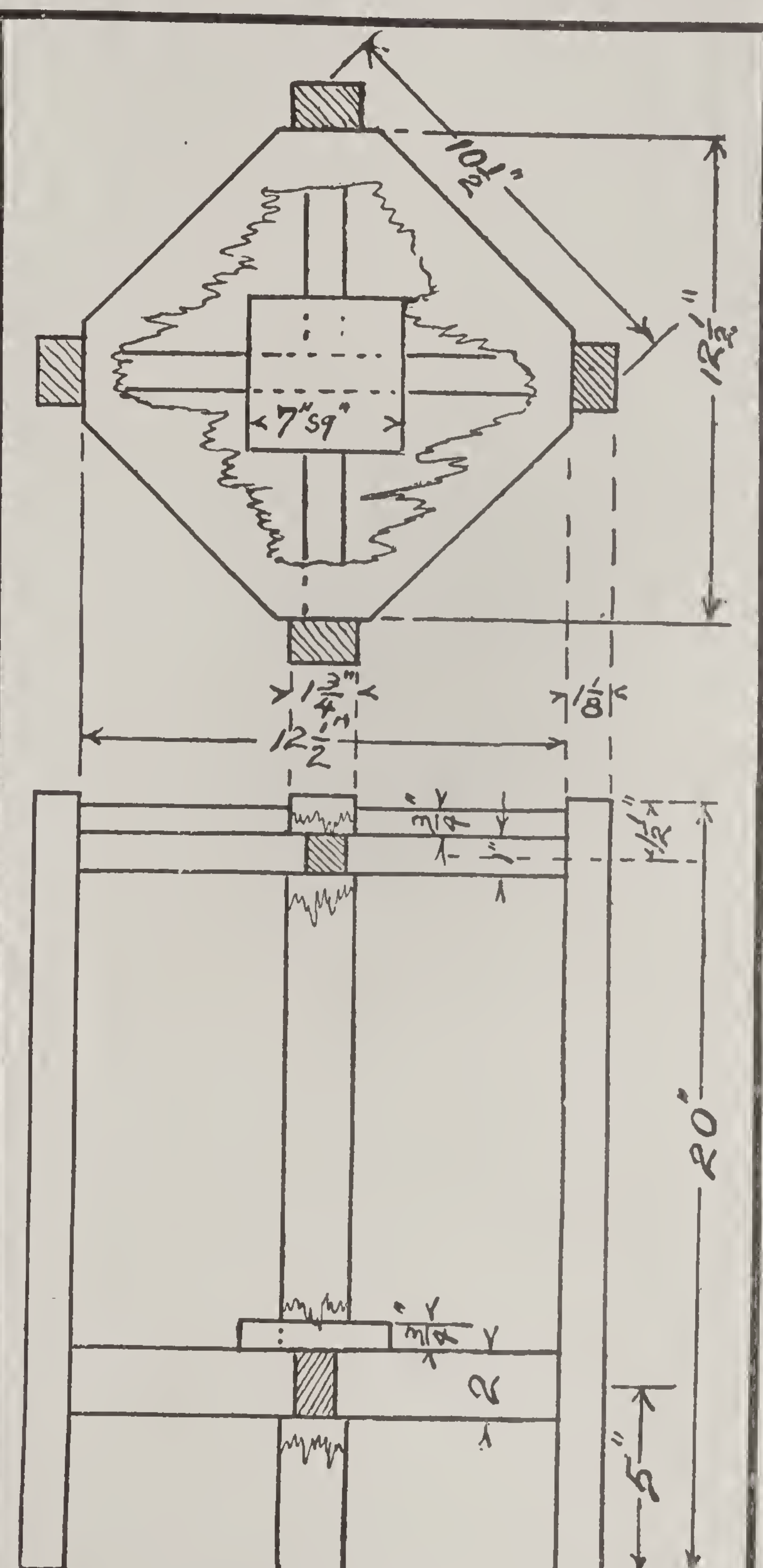
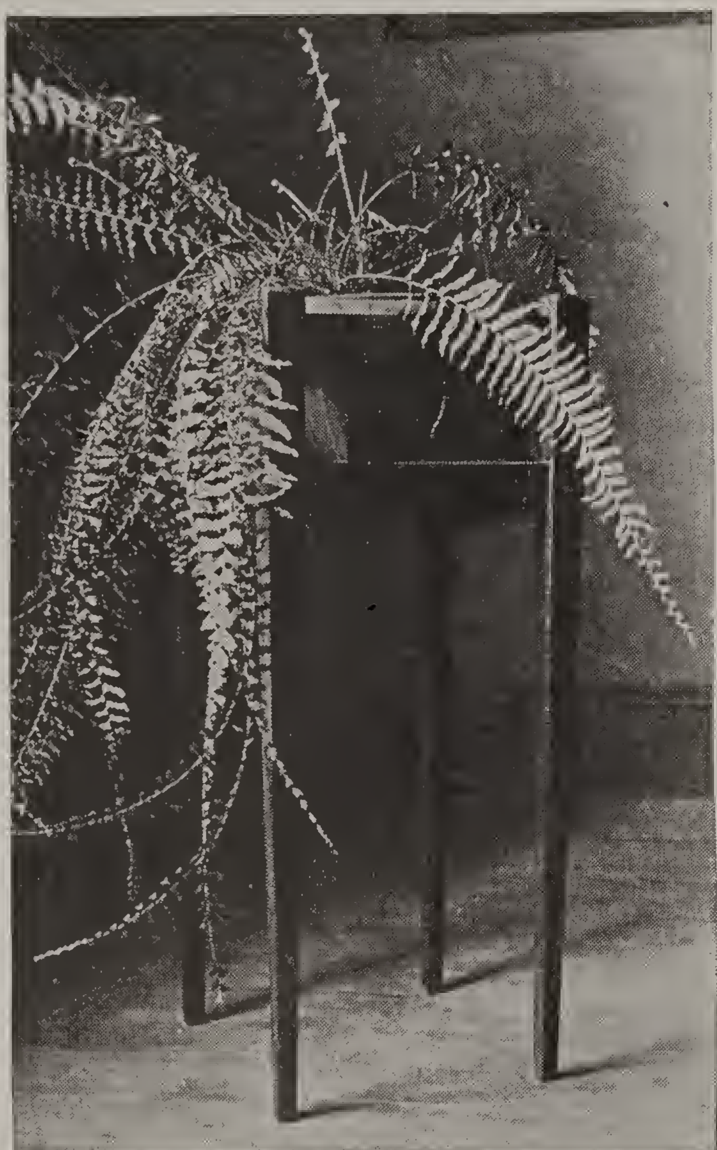


Plate XII
PLAN 19. TABORET
Stock list, kiln-dried chestnut or oak.

	Inches
4 legs	1⅛ x 1¾ x 20
2 upper cross members	1 x ⅞ x 12½
2 lower	2 x ⅞ x 12½
1 shelf	¾ x 7 x 7
1 top	¾ x 10½ x 10½

For the mortise, first square two lines across the face of the stock corresponding in location to the location and width of the tenon member. (See Fig. 30.) *In* from these, measure for the end shoulders and square two more lines across the face of the mortise member. This latter pair of lines locates the ends of the mortise. Between these, with the mortise gage, lay out the width of the mortise which must correspond to the thickness of the tenon. In setting the mortise gage, first set its two points apart, the thickness of the tenon. This is done by releasing the set screw on the head and turning the thumb screw on the end of the gage. Then set the head to obtain the correct distance from face side of the stock to the mortise. If the mortise is to be centered, try the gage from both sides of the stock, varying the adjustment of the head until the points register the same

The Fern Stand



Having the mortise correctly laid out as described above and shown in Fig. 32, with a bit whose diameter equals the width of the mortise, bore to the desired depth as shown in Fig. 33, cutting away as much wood as possible with the bit. Finish the ends of the mortise, first using the mortise chisel. Using the mallet, drive the chisel in squarely, bevel side toward the mortise, to the full depth of the bit holes and break it over toward the bevel. Finish the mortise sides with a wider paring chisel. Do not "undercut" so as to make the mortise larger at the bottom than at the surface of the stock. Such a joint cannot hold.

For the tenon, first cut the stock to the length called for between the two mortise members plus twice the length desired for the tenon (assuming that one is to be cut on both ends of the stock). Measure from the end of stock the length of the tenon and square a line entirely around the stock, drawing the lines with a knife point. Remember in squaring for joints to work carefully from properly marked "face sides." Notice the face marks x in Figs. 31 and 32. Having the shoulder line properly established, with a common marking gage set to correspond to the size of the end shoulders, gage for both these from either side.

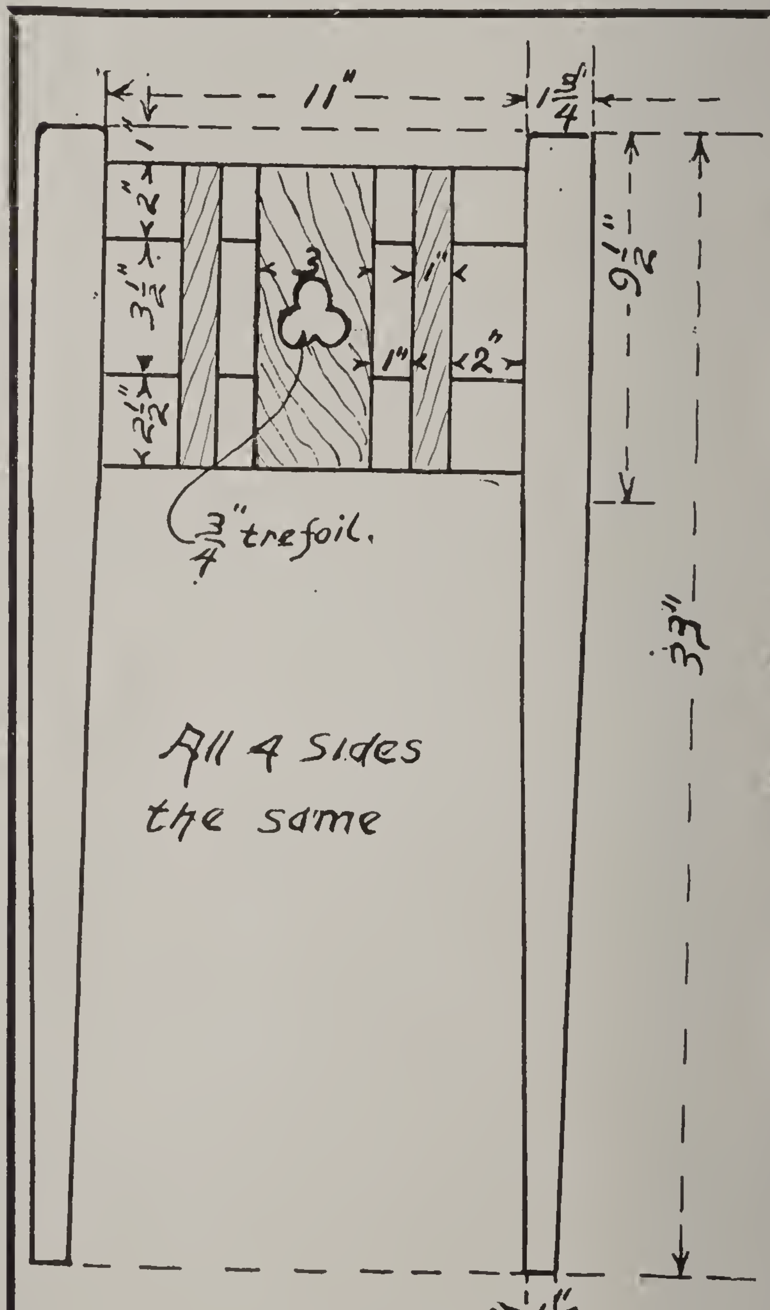


Plate XIII

PLAN 20. FERN STAND.

Stock list, kiln-dried chestnut or oak.

	Inches
4 posts	$1\frac{3}{4}$ x $1\frac{3}{4}$ x 33
4 rails	$\frac{3}{4}$ x 2 x 13
4 rails	$\frac{3}{4}$ x $2\frac{1}{2}$ x 13
8 slats	$\frac{3}{8}$ x 1 x 8
4 slats	$\frac{3}{8}$ x 3 x 8
1 shelf	$\frac{1}{2}$ x 12 x 12

shoulders. Begin at the shoulder line. Gage from this to the end of the stock, then across the end, and lastly down to the shoulder line on the opposite side. With the mortise gage set with the same distance between the points as was used in laying out the corresponding mortise and with this space centered on the thickness of the tenon member, gage a double line from the shoulder line on one edge of the stock to the end, across the end and to the shoulder line on the opposite edge. Fig. 32 shows the appearance of the tenon laid out ready for cutting, and also the first step in cutting the tenon. Be sure to run the saw *outside* but neatly touching the gage lines.

You will find that you will require considerable practice before being able to make all four cuts perfectly. In Fig. 33 the first cut to the shoulder line has been made and the saw is entering the second. Fig. 34 shows the last cut and Fig. 30, the joint completed ready to go together. If the shoulder cuts have been rightly made, the shoulders will fit squarely and tightly against the face of the mortise member. If the tenon is a trifle too large for the proper driving fit, pare the sides across the grain with a sharp chisel. Use care, for it requires but a little cutting to make a loose fit and spoil what was a good job.

Fig. 35. Using the Cabinet Scraper

Fig. 36. Setting the T-Bevel

It might be well to say at this point that all the projects that follow make use of the mortise and tenon joint. You should not undertake their construction until you have mastered the making of this joint and have had considerable experience with all the tool work previously explained. All the work outlined is carefully graded and it is assumed that before any project is undertaken, all the tool work up to that point has been done. With

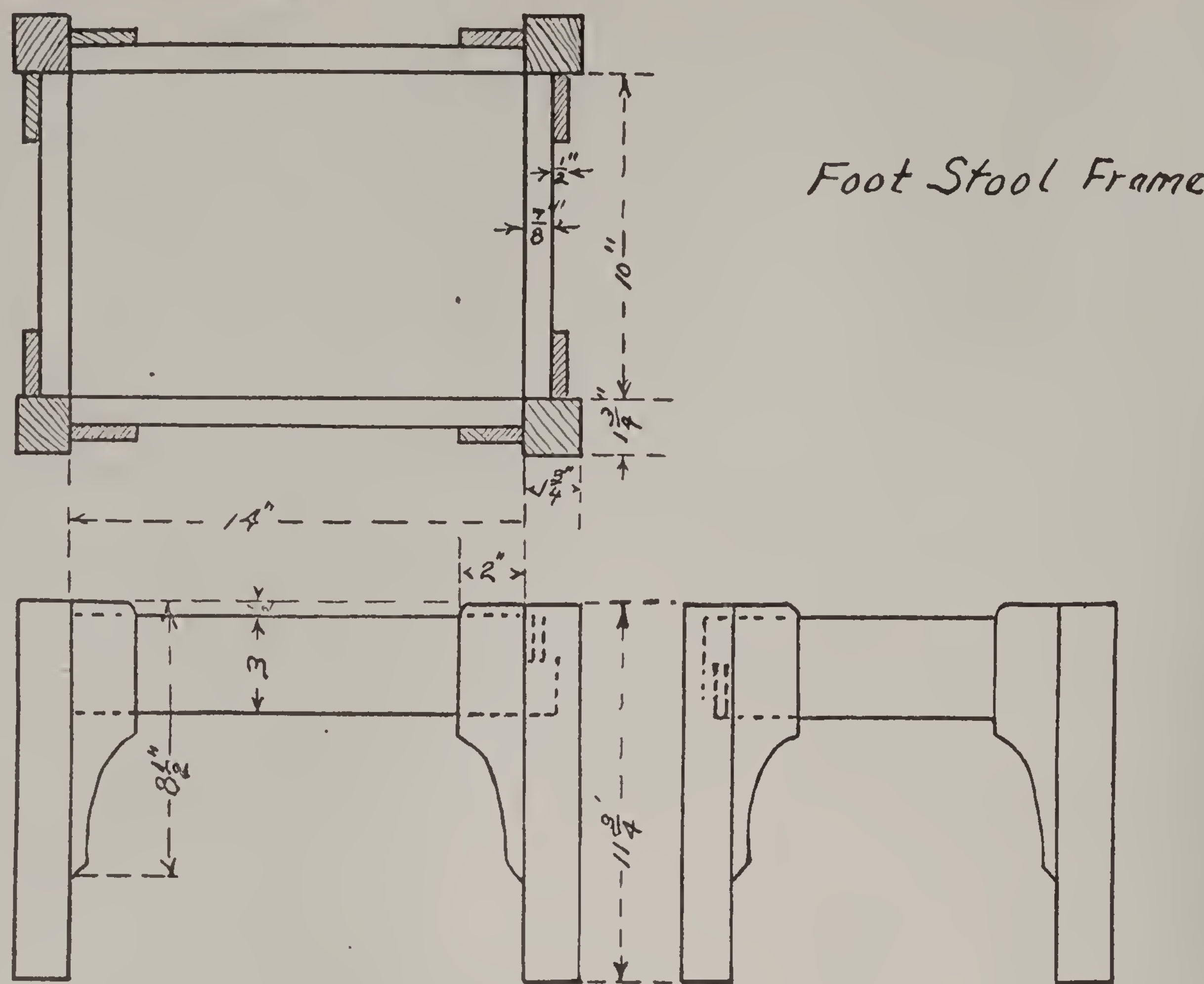


Plate XIV

PLAN 21. FOOTSTOOL FRAME

Stock list, kiln-dried hardwood.

	Inches
4 posts	1¾ x 1¾ x 11¾
2 rails	⅞ x 3 x 16
2 rails	⅞ x 3 x 12
8 brace members	½ x 2 x 8½

each new project all the new work is explained. Once directions are given, they are not repeated, e.g., curve cutting is explained in connection with the clothes pole, Plate XI, Plan 18, although curve cutting occurs in many of the projects that follow, nothing further is said about it.

In the plans many details, such as invisible edges and interior construction have

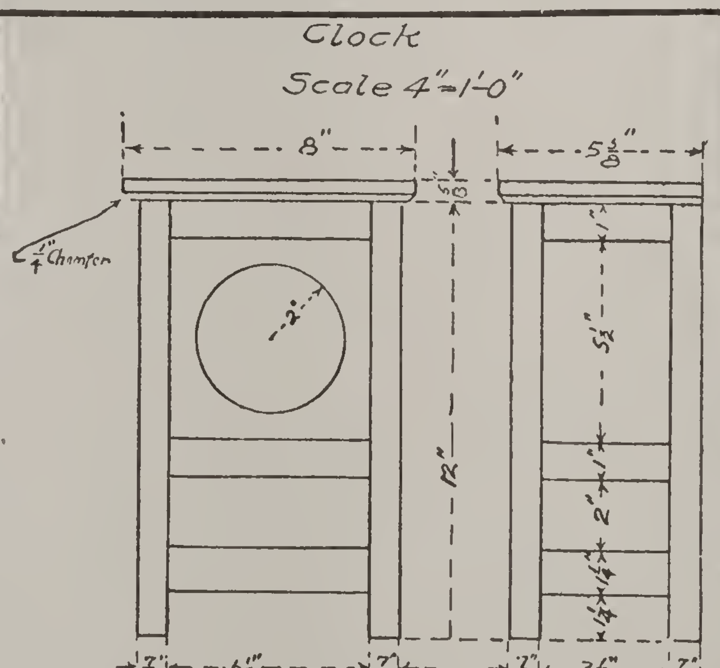


Plate XV

PLAN 22. ALARM CLOCK CASE

Stock list, any suitably seasoned lumber

	Inches
4 posts	⅞ x ⅞ x 12
4 rails	⅝ x 1 x 6¾
2 rails (lower)	⅝ x 1¼ x 6¾
4 upper side rails	⅝ x 1 x 4¾
2 lower side rails	⅝ x 1¼ x 4¾
1 face board	¼ x 5½ x 7½
2 side boards	¼ x 3½ x 7½
1 top	⅝ x 5⅝ x 8

Clock-shelf fitted in assembled frame resting on cleats at correct height to fit clock used.

been omitted for the sake of clearness. The stock list and your own mechanical sense will furnish all the information not conveyed in the plans.

Plate XIII, Plan 20, is a fern stand much like the one in one of the pictures. This affords a good problem for the first mortise and tenon construction. Notice by the stock list that the rails (tenon members) are ¾-inch

thick, and plan the size of the tenons as suggested in the directions. First, get out the posts to stock size; then lay out and cut the mortises, four in each post or two in each face. The mortises are centered and if cut 1¼-inch deep, will open directly into each other. In joints like these, the ends of the tenons should be cut to a 45-degree miter, otherwise one tenon will be much too short and will not make a strong joint. The slats in the drawing are nailed on; they may be mortised in the edges of the rails. If the latter is done, they must be in place before the rails are glued into the posts. Cut the tapers on the posts and have all parts perfectly

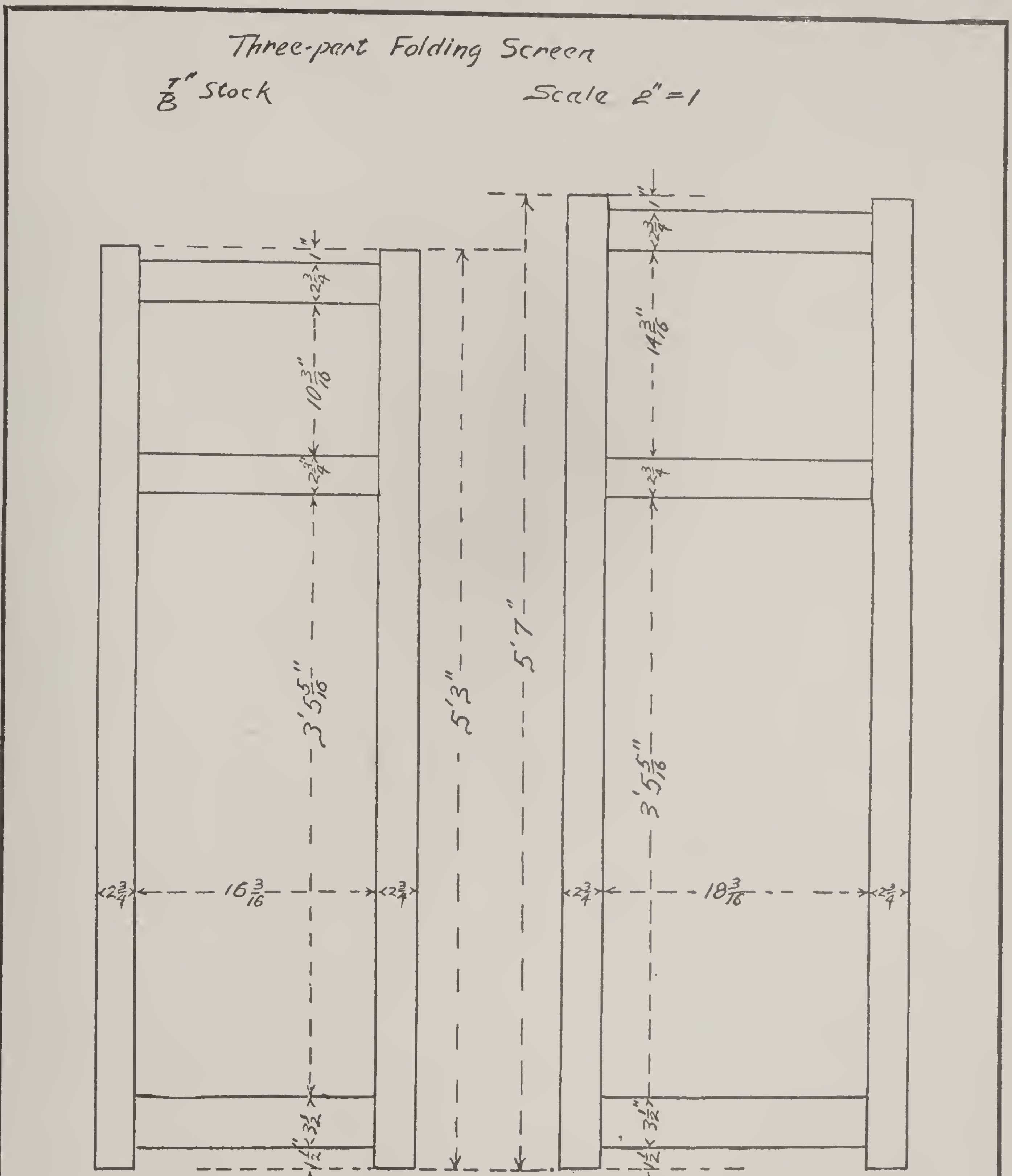


Plate XVI

PLAN 23. THREE-PART FOLDING SCREEN

Stock list, kiln-dried quarter-sawed oak. (For each small section.)

	Inches		For the middle section.
2 stiles	⅞ x 2¾ x 63	2 stiles	⅞ x 2¾ x 67
2 rails (upper)	⅞ x 2¾ x 18 3/16	2 rails (upper)	⅞ x 2¾ x 20 3/16
1 rail (lower)	⅞ x 3½ x 18 3/16	1 rail (lower)	⅞ x 3½ x 20 3/16

smoothed before gluing up. If you make the piece of hardwood, you will need to use the cabinet scraper to properly smooth it for finishing, Fig. 35. In assembling, glue it up in sections; first glue two opposite sides, being sure that posts are in proper position to receive the other rails when the first gluing is dry and the assembling is completed. In clamping, place soft wood blocks between the clamps and the work, and be sure that the clamping does not "roll" the post, leaving an open joint on one side. This may be avoided by shifting the position of the loose blocks so that the clamp bearing is directly in line with the rails. Be sure that work is clamped up "square," drawn together firmly, and that when left to dry it is "out

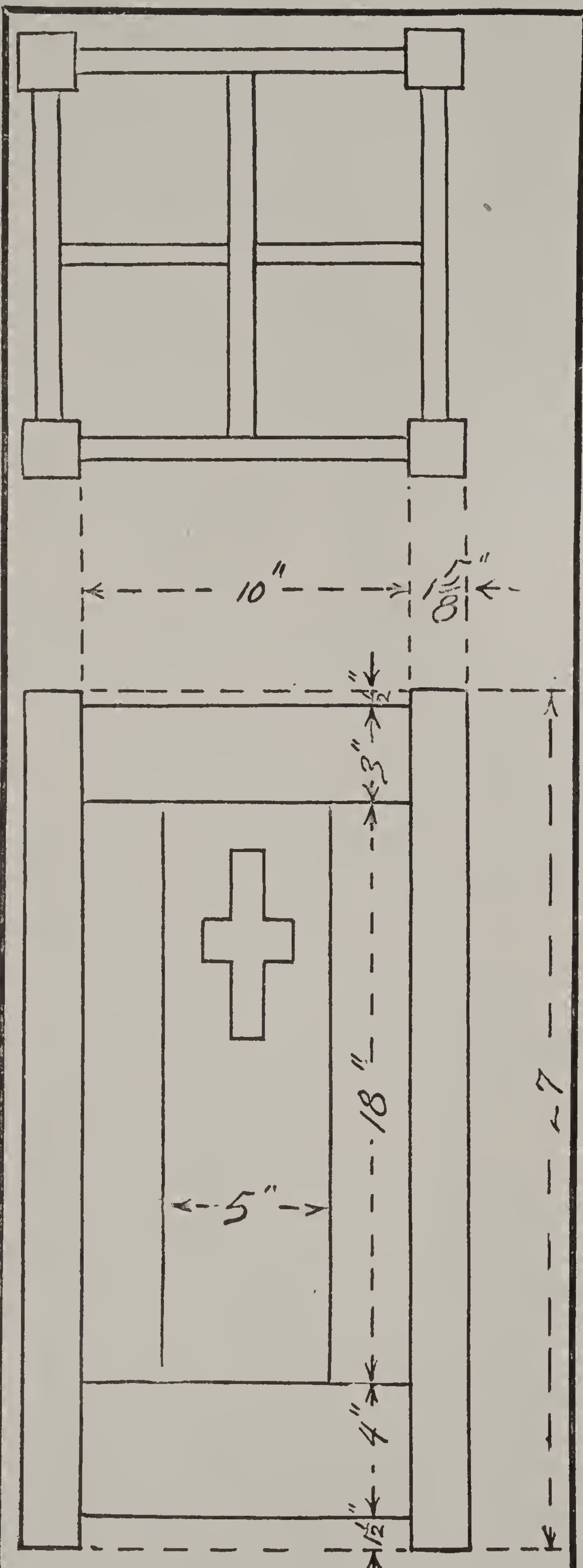
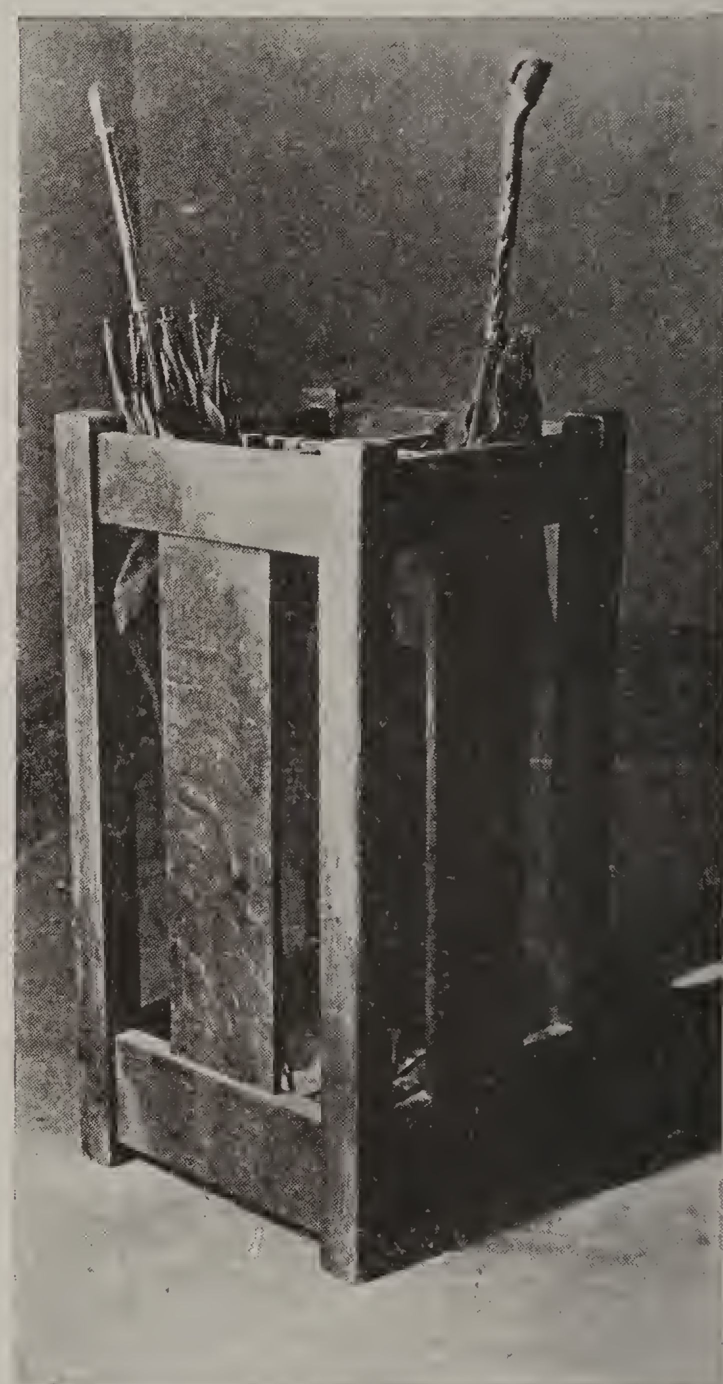


Plate XVII

PLAN 24. UMBRELLA HOLDER

Stock list, kiln-dried stock, oak preferred. See if you can make this stock list yourself.



of wind" (long i in "wind"). The latter may be ascertained by looking across the posts of the section as you would place your eye on a level with a wide surface to see if it were warped or twisted.

The drawing does not show the shelf. This may be of soft wood and placed on cleats that are fastened with screws to the lower inside surfaces of the lower rails. Cut the corners of this shelf away on a quarter circle to avoid fitting them to the posts. Plate XIV, Plan 21, is a footstool, the construction of which needs little discussion after the fern

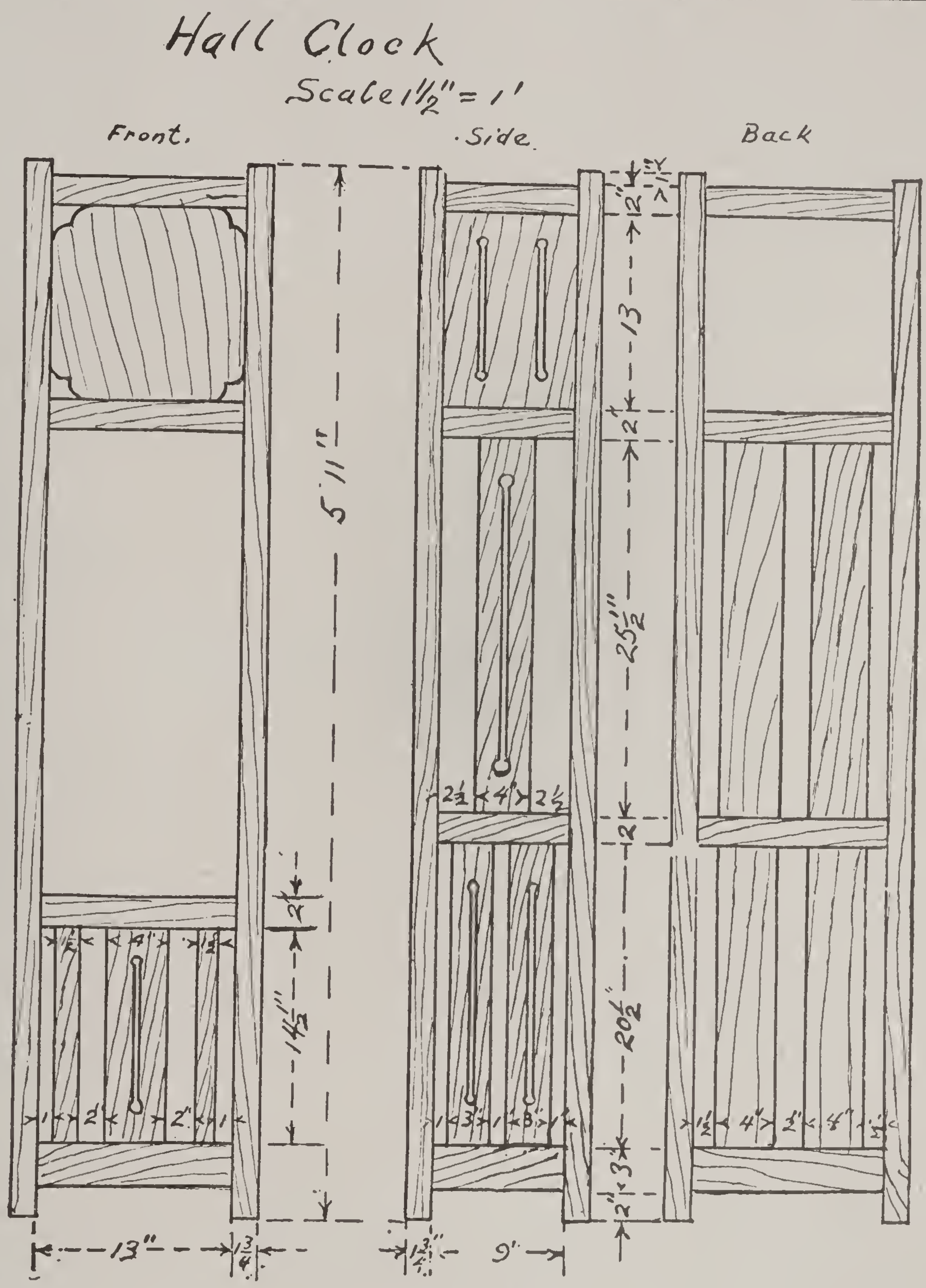


Plate XVIII

PLAN 25. HALL CLOCK

Stock list, kiln-dried, quarter-sawed white oak.

	Inches		
4 posts	1¾ x 1¾ x 71	2 front slats	⅜ x 1½ x 15½
6 rails	¾ x 2 x 15	1 front slat (wide)	⅜ x 4 x 15½
2 rails (lower)	¾ x 3 x 15	4 side slats (lower)	⅜ x 3 x 21½
6 side rails	¾ x 2 x 11	2 side slats (middle)	⅜ x 4 x 26½
2 side rails (lower)	¾ x 3 x 11	2 side panels	⅜ x 9 x 13½
1 face	⅜ x 13 x 13	2 back slats (lower)	⅜ x 4 x 21½
		2 back slats (middle)	⅜ x 4 x 26½

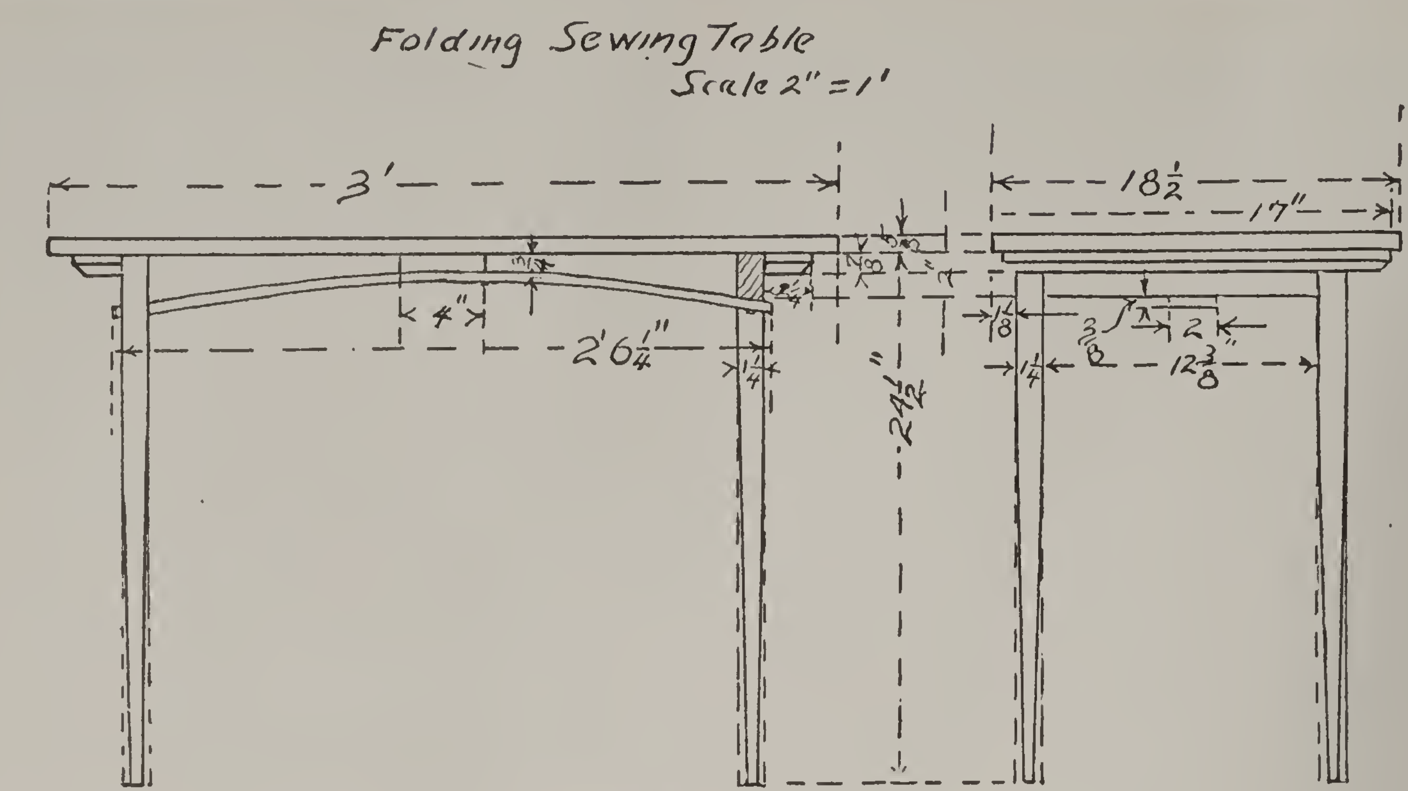


Plate XIX

PLAN 26. SEWING TABLE.

Stock list, seasoned birch or cherry.

	Inches
4 posts	1¼ x 1¼ x 24½
2 rails	1¼ x 1¼ x 24½
2 cleats	⅞ x 2¼ x 17
1 spring board	⅜ x 2 x 30¼
1 spring board block	¾ x 3 x 4
1 top	⅝ x 18½ x 36

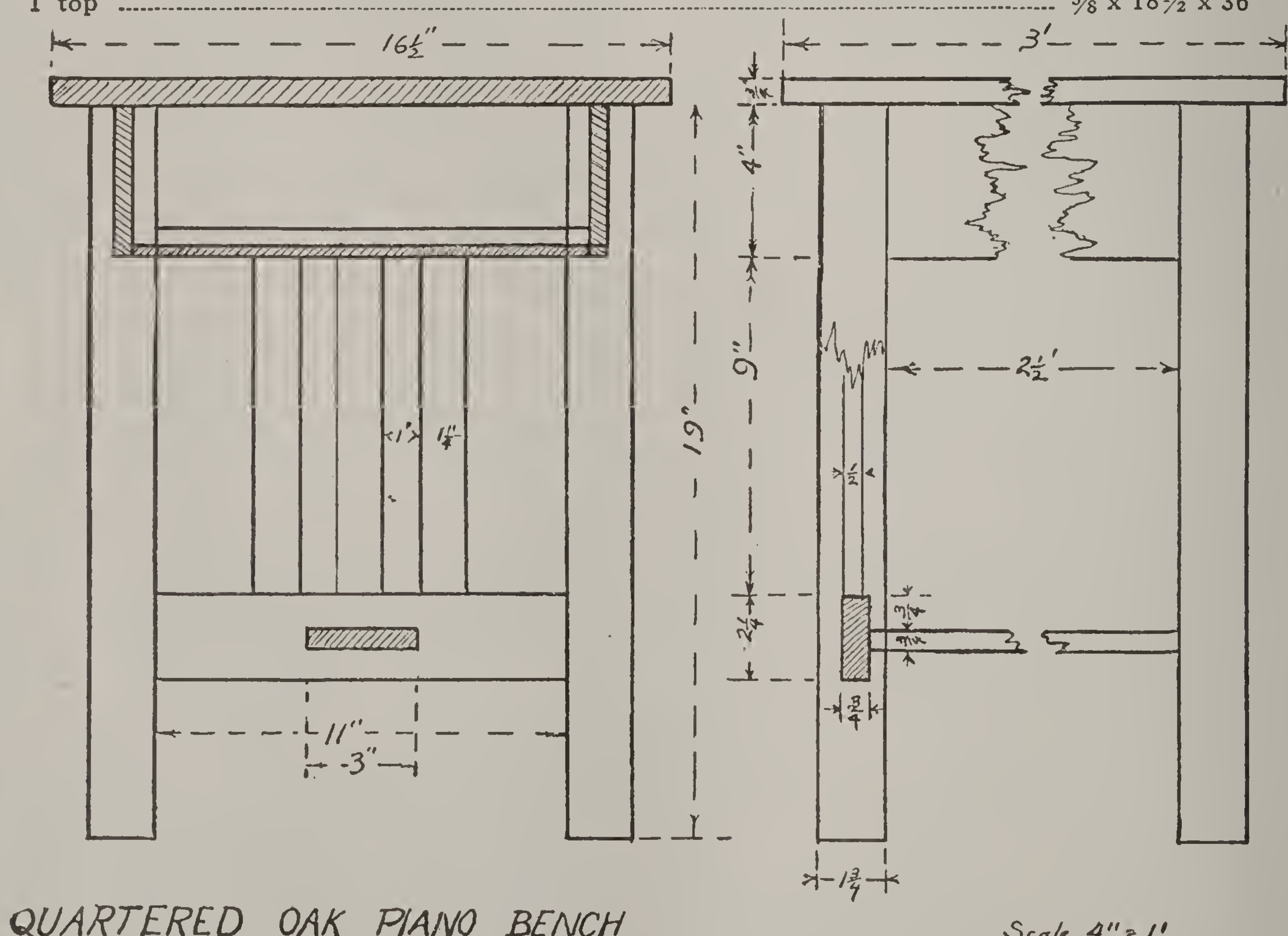


Plate XX

PLAN 27. PIANO BENCH

Stock list, kiln-dried hardwood, oak preferred.

	Inches
4 posts	1¾ x 1¾ x 19
2 end rails (upper)	¾ x 4 x 13
2 end rails (lower)	¾ x 2¼ x 13
2 side rails	¾ x 4 x 32
1 brace bar	¾ x 3 x 33½
6 end slats	⅝ x 1¼ x 10
1 top	⅞ x 16½ x 36

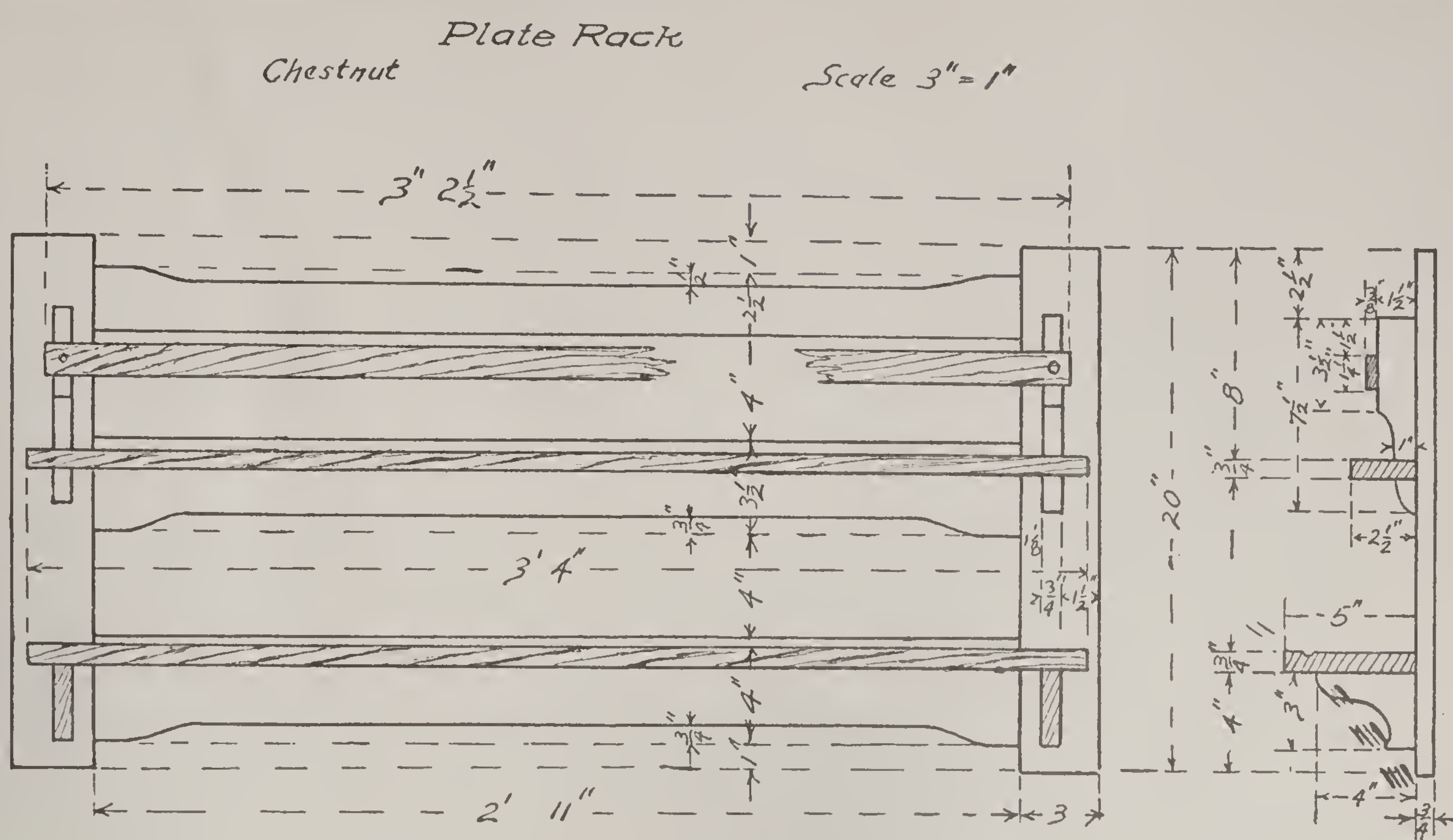


Plate XXI

PLAN 28. PLATE RAIL

Stock list, kiln-dried quarter-sawed white oak

	Inches
2 stiles	¾ x 3 x 20
1 upper rail	¾ x 2½ x 37
1 middle rail	¾ x 3½ x 37
1 lower rail	¾ x 4 x 37
2 brackets	¾ x 1½ x 7½
2 shelf rests	¾ x 3 x 4
1 plate rail	⅜ x 1¼ x 38½
1 shelf (top)	¾ x 2½ x 40
1 shelf (bottom)	¾ x 5 x 40

WALL BOOK SHELF.

Specifications

Material- Solid mahogany throughout. Finish- Mahogany stain, filler and 2 coats Mission-lac; the first cut with 00 sd-paper and the last rubbed to a dull gloss.

Scale 3"=1'

P.S.N.S.
MANUAL TRAINING
DEPARTMENT
1910

Construction.

Regulation panel work for back. Tenons centered, 1" long, ¼" thick with ¼" shoulders. Grooves ¼" deep. Shelves housed ¼" into ends. Shelves and ends fastened to back with 1¼" FHB screws.

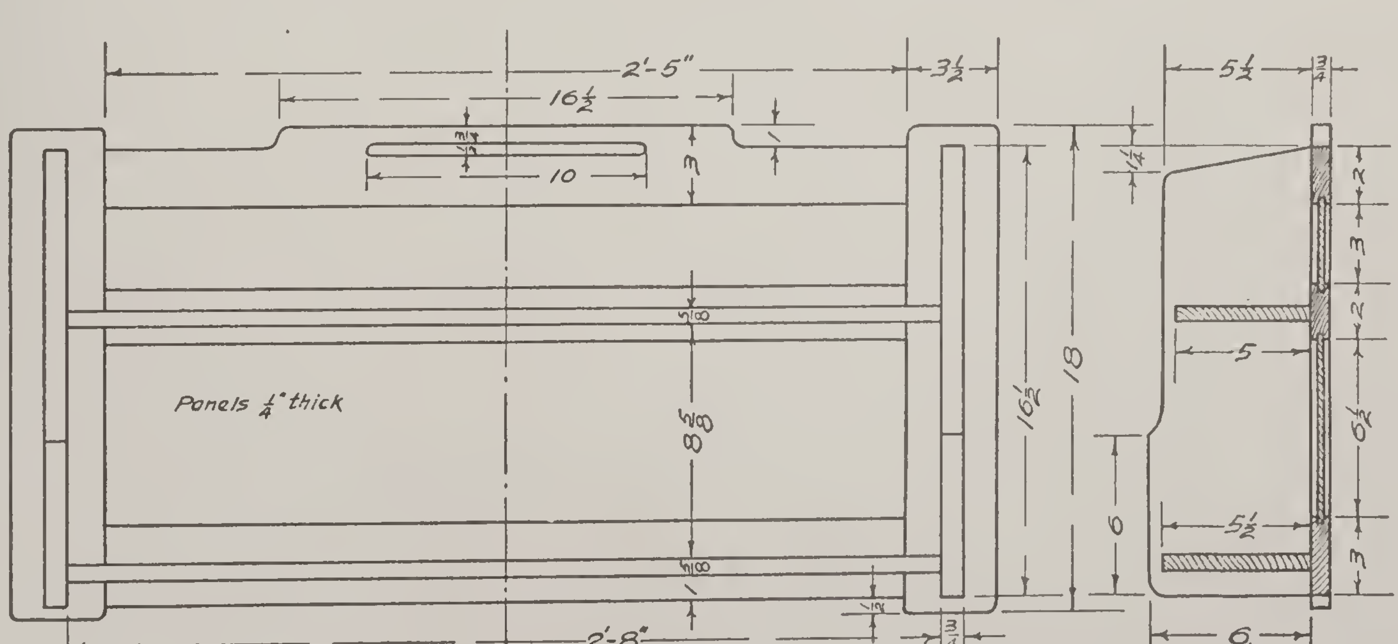


Plate XXII

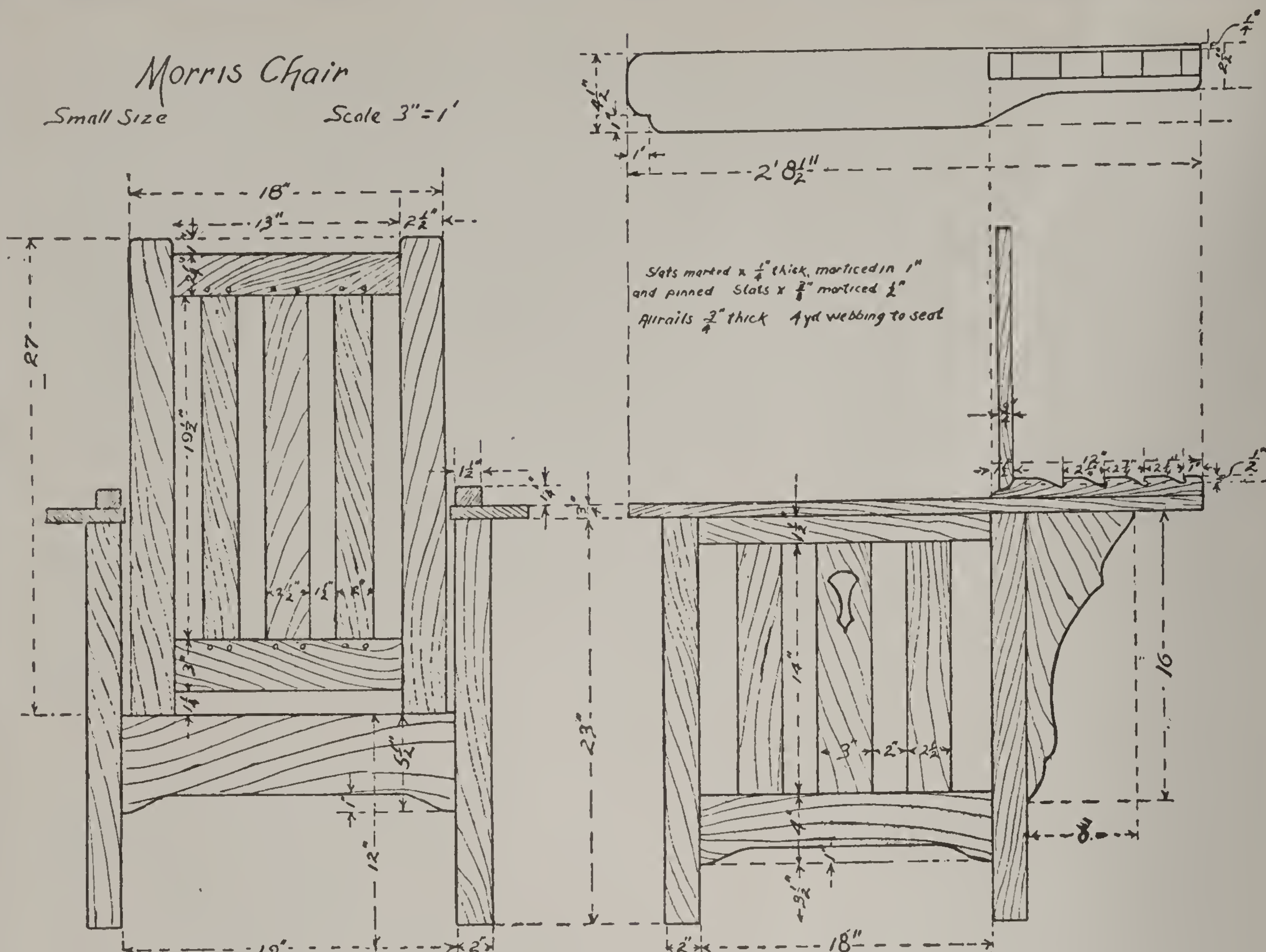


Plate XXIII

PLAN 30. MORRIS CHAIR

Stock list, kiln-dried quarter-sawed white oak

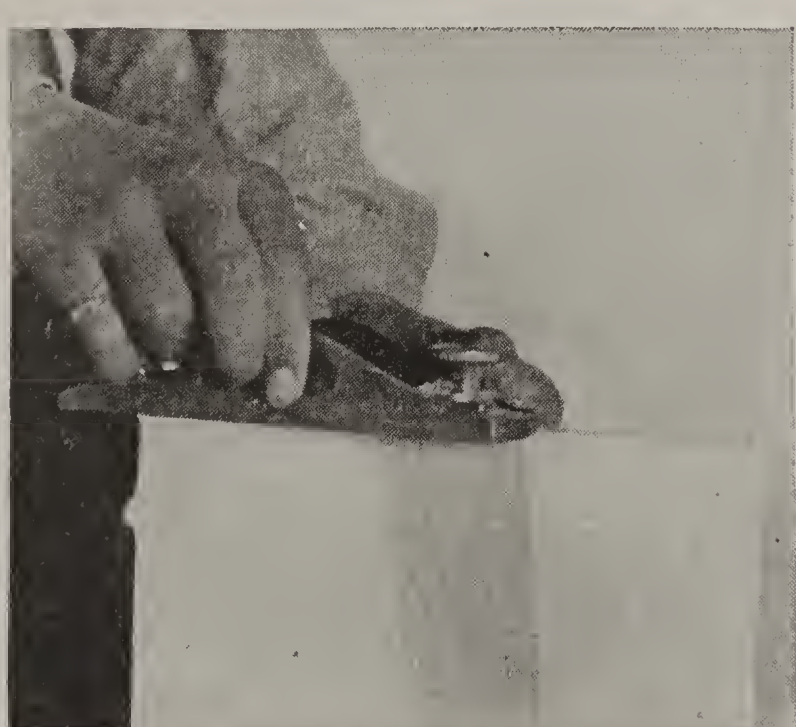
	Inches
4 posts	2 x 2 x 23
2 rails, back, front	3/4 x 5 1/2 x 21
2 rails (upper side)	3/4 x 1 1/2 x 20
2 rails (lower side)	3/4 x 4 x 21
4 side slats	3/8 x 2 1/2 x 15
2 side slats	3/8 x 3 x 15
2 brace members	3/4 x 6 x 16
2 arms	3/4 x 4 1/2 x 32 1/2
2 rod rests	1 1/4 x 1 1/2 x 12

Back

2 stiles	3/4 x 2 1/2 x 27
1 rail (upper)	3/4 x 2 1/4 x 15
1 rail (lower)	3/4 x 3 x 15
2 slats	3/8 x 2 x 21
1 slat	3/8 x 2 1/2 x 21

Cleats and slats under cushion fitted after frame is assembled.

Fig. 37. Using the Block Plane



stand has been built. Note, however, that the rails are flush with the inside or face surfaces of the posts, and note the dotted lines on the side and end views that indicate how the tenons and mortises are arranged. Be careful in cutting the mortises not to split the posts. Glue the braces to the posts, fasten them near the bottom and screw the tops on from the inside of the rails. This stool is intended for a leather or tapestry top. This should be nailed to the top of the rails; then turn the stool over, pack suitable filling

material into the frame, over this lay a board that fits tightly, force it firmly down on the packing, and hole in the beam of the marking gage in the end opposite the spur. Fit a lead pencil into this hole and

Book Shelves

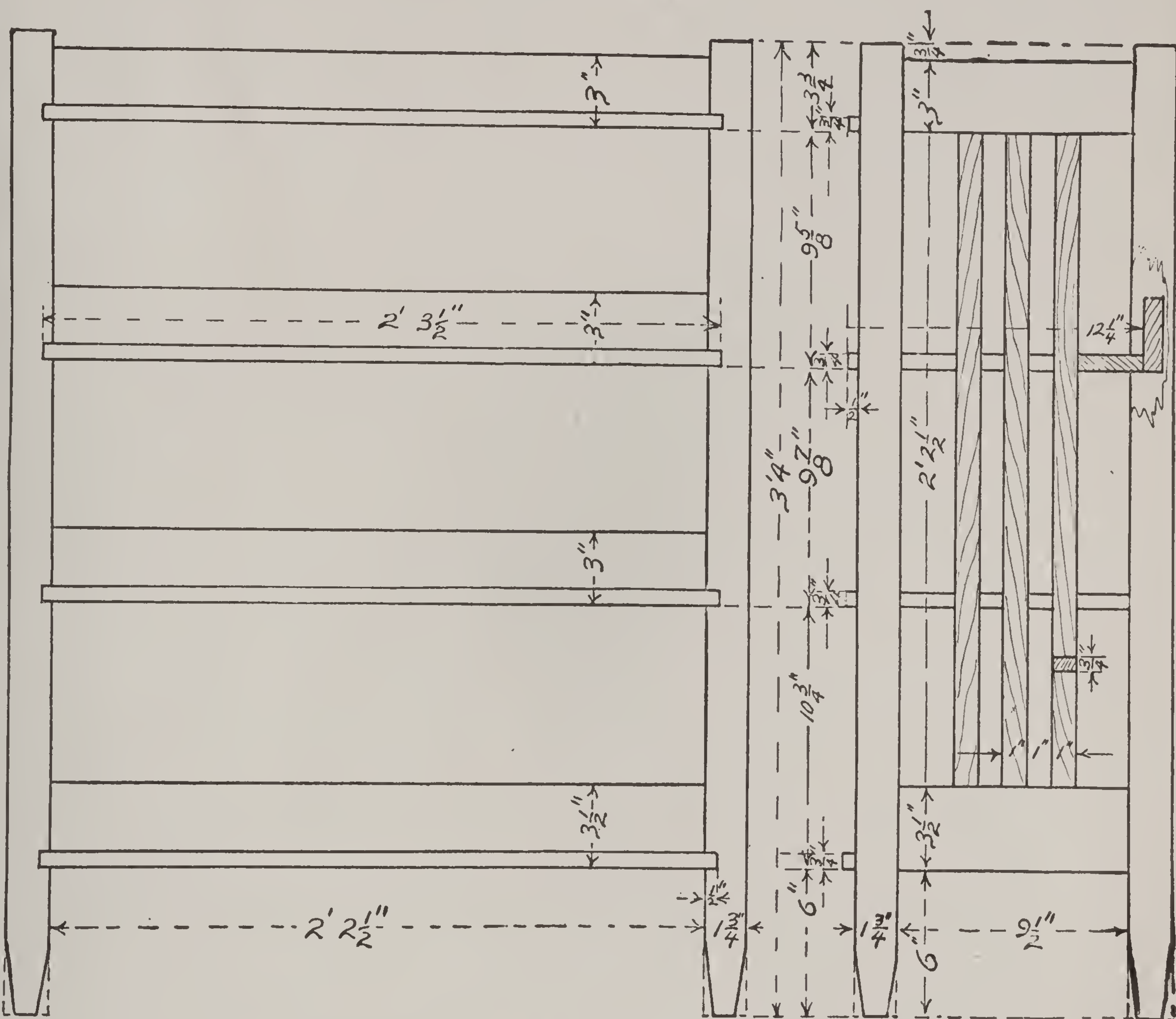


Plate XXIV

PLAN 31. BOOK SHELVES

Stock list, kiln-dried hardwood, oak preferred.

	Inches
4 posts	1¾ x 1¾ x 40
3 rails (back)	¾ x 3 x 28½
1 rail (back bottom)	¾ x 3½ x 28½
2 rails (upper side)	¾ x 3 x 11½
2 rails (lower side)	¾ x 3½ x 11½
6 slats	¾ x 1 x 27½
4 shelves	¾ x 12¼ x 27½

fasten in place with cleats screwed to the end rails.

Plate XV, Plan 22, involves smaller joints than the preceding projects. The front and side panels are fastened to the inside of the rails, as is also the shelf on which the clock stands. To lay out the chamfer along the top board, bore a gage as with the spur, first ascertaining the right measurement with the ruler. Cut the chamfer with the block plane with a shearing cut, testing the work with the T-bevel set as in Fig. 36.

The screen frames shown in Plate XVI, Plan 23, involve no new difficulties except those which come

from their size. For these and for all the larger pieces of hardwood furniture to follow it will be advisable to have the stock cut to the required dimensions at some local mill. Make two of the smaller frames and one large one. After they are stained and finished, cover the top panels with tapestry or with some other suitable material, and remember that both sides will show when finished. Cover the top panels with tapestry, plain denim or burlap of a harmonious color. Then finish along the edges with upholsterer's gimp and fancy nails, evenly spaced. Between the screens, use three fancy surface hinges of brass, placing one set on one side of the screen and the other set on the opposite side.

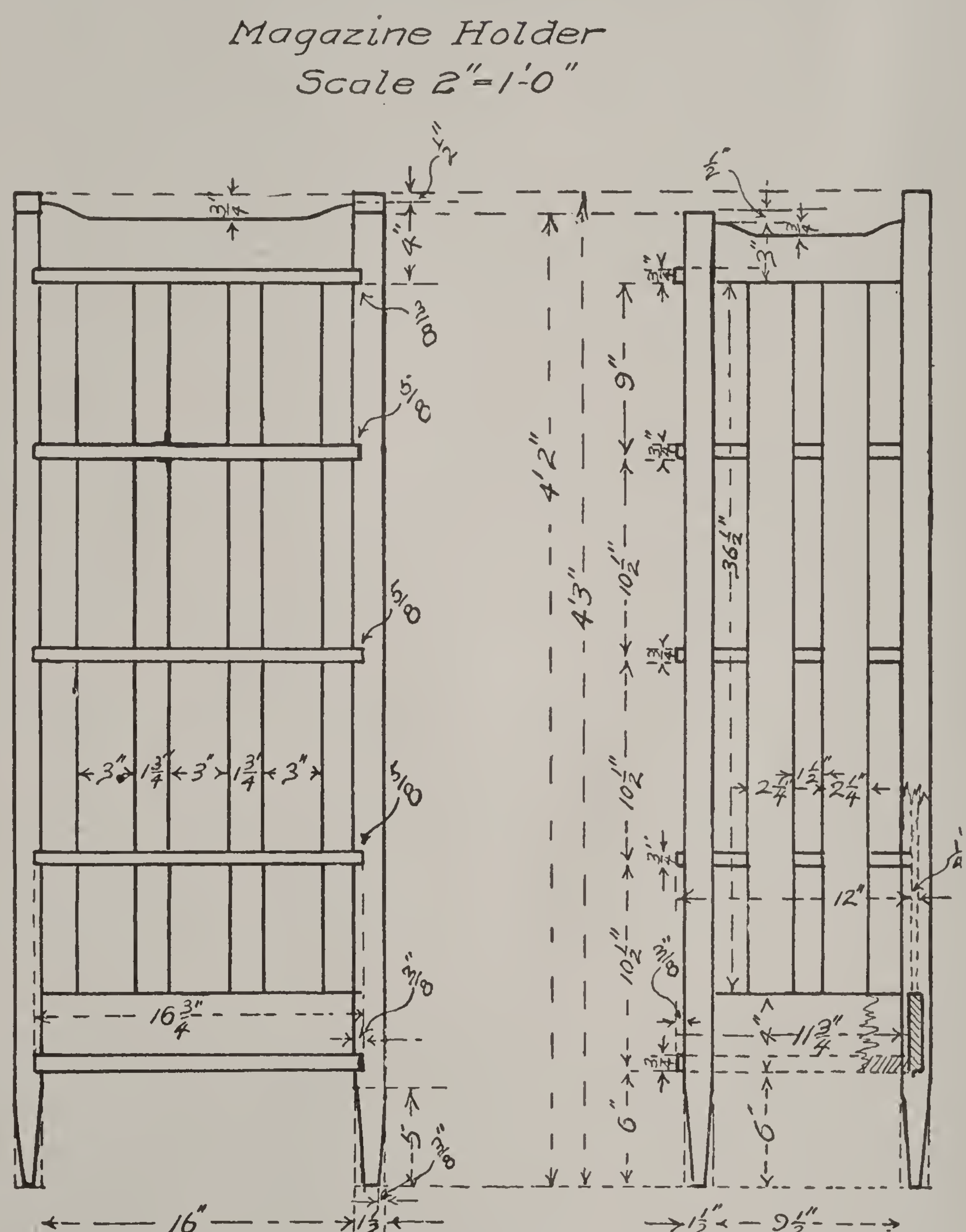


Plate XXV

PLAN 32. MAGAZINE HOLDER.

Stock list, kiln-dried quarter-sawed white oak.

	Inches
2 front posts	1½ x 1½ x 50
2 rear posts	1½ x 1½ x 51
2 rear rails	¾ x 4 x 18
2 side rails (upper)	¾ x 3 x 10½
2 side rails (lower)	¾ x 4 x 10½
4 side slats	¼ x 2¼ x 37½
3 back slats	¼ x 3 x 37½
2 shelves	¾ x 11¾ x 16¾
3 shelves	¾ x 12 x 17¼

The umbrella stand, Plate XVII, Plan 24, should have a shelf placed

in the bottom as described for the fern stand, Plan 20. This shelf should have a round hole cut to re-

half jointed together at their centers, and fitted in, after the remainder of the job is assembled.

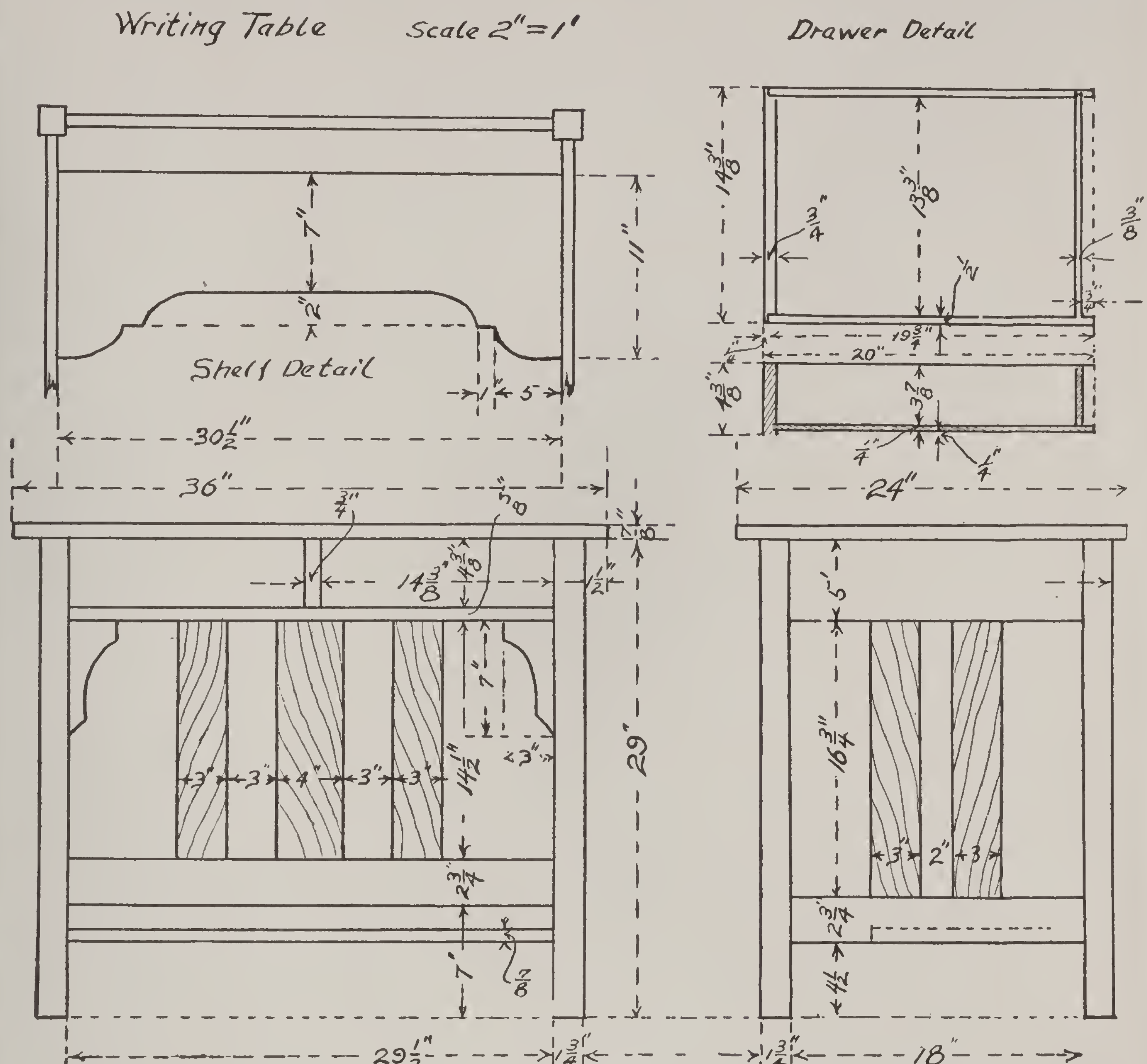


Plate XXVI

PLAN 33. WRITING TABLE.

Stock list, kiln-dried quarter-sawed white oak

	Inches
4 posts	1¾ x 1¾ x 29
2 top end rails	¾ x 5 x 20
2 lower end rails	¾ x 2¾ x 20
1 top back rail	¾ x 5 x 31½
1 lower back rail	¾ x 2¾ x 31½
4 end slats	⅜ x 3 x 17¾
2 back slats	⅜ x 3 x 15½
1 back slat (wide)	⅜ x 4 x 15½
1 front rail	¾ x 1¾ x 31½
1 drawer partition	¾ x ¾ x 4⅜
1 shelf	⅞ x 11 x 30½
1 top	⅞ x 24 x 36
For each drawer.	
1 front	¾ x 4⅜ x 14⅜
1 back (soft wood)	⅜ x 3⅞ x 13⅞
2 sides (soft wood)	½ x 4⅜ x 19¾
1 bottom (soft wood)	¼ x 19½ x 13⅞

ceive a deep agate pie plate to catch the drippings of the umbrellas. The cross bars in the top are made long,

The side slats may have a decorative opening cut in them with the coping saw, if desired.

The hall clock, Plate XVIII, Plan 25, is not difficult, but is a long job. Be sure to secure perfectly straight stock for the four corner posts and do accurate work or you will have trouble in assembling. If desired, the slats may be made to nail on the outside of the rails instead of mortising in, as in the plan. Any reliable local dealer can obtain works for this clock for from $10 up, and will tell you how to put them in. Make the face of your clock so that it can be removed from the front to provide for inspection of the works from time to time.

The end view of the sewing table, Plate XIX, Plan 26, shows only one pair of legs; the other pair is offset to the right so they will not interfere with each other when folded. The top for this will be made more attractive if glued up in strips of light and dark wood. Be sure your lumber is well seasoned, otherwise it will not stay glued. Kiln-dried lumber is the best. Have the long joints prepared at the mill. Follow directions for setting dowels, Fig. 25, and make up the top longer and wider than finished dimensions, cutting to size after gluing is dry. To

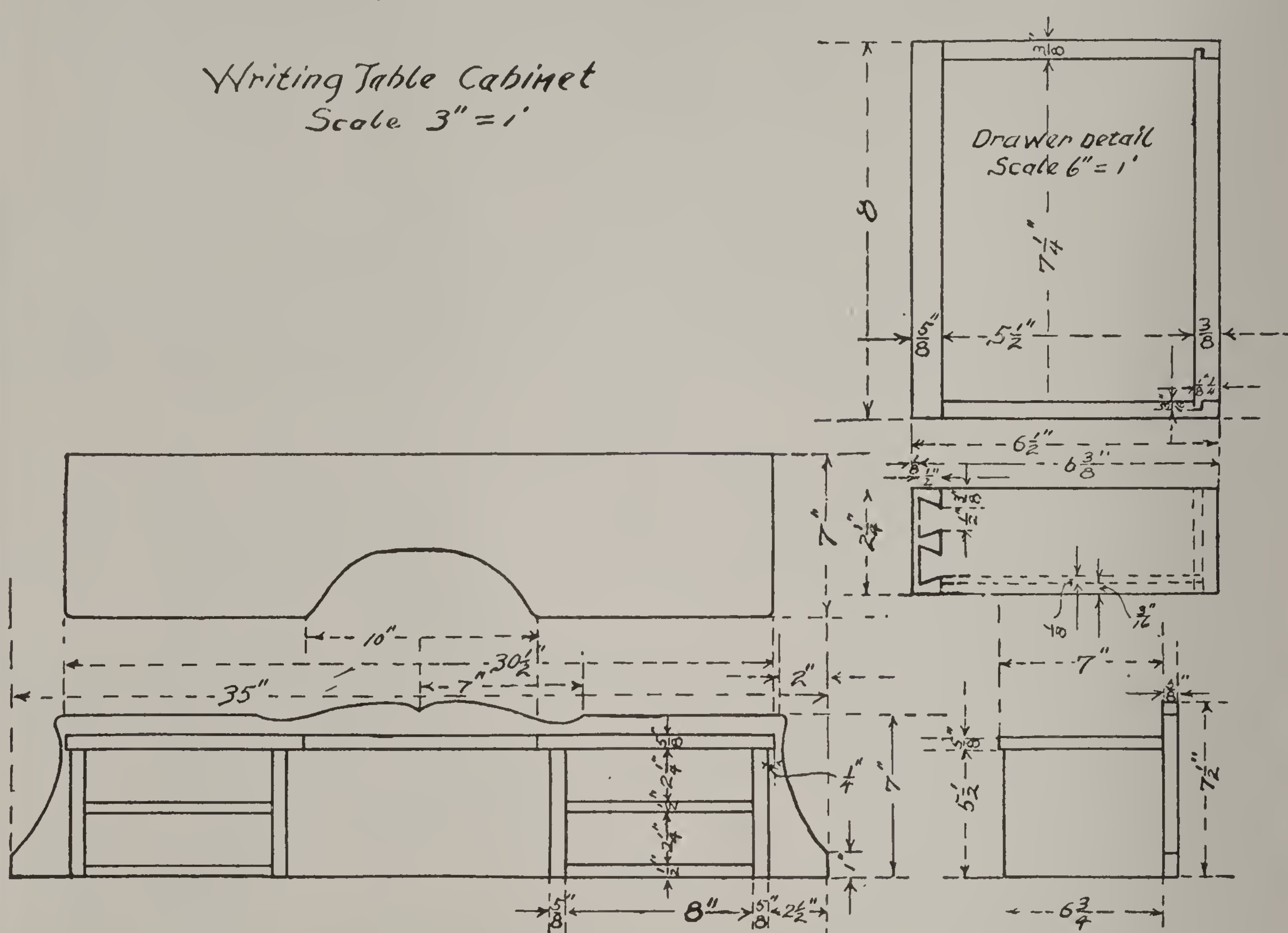


Plate XXVII

PLAN 34. WRITING TABLE CABINET

Stock list, kiln-dried quarter-sawed white oak

		Inches
1	back	⅝ x 7½ x 35
1	top shelf	⅝ x 7 x 30½
4	ends	⅝ x 6¾ x 5¾
4	shelves	½ x 6¾ x 8½
	Each small drawer.	
1	front	⅝ x 2¼ x 8
1	back	⅜ x 2¼ x 7⅝
2	ends	⅜ x 2¼ x 6⅜
1	bottom	¼ x 5¾ x 7½
	(Last three items soft wood.)	

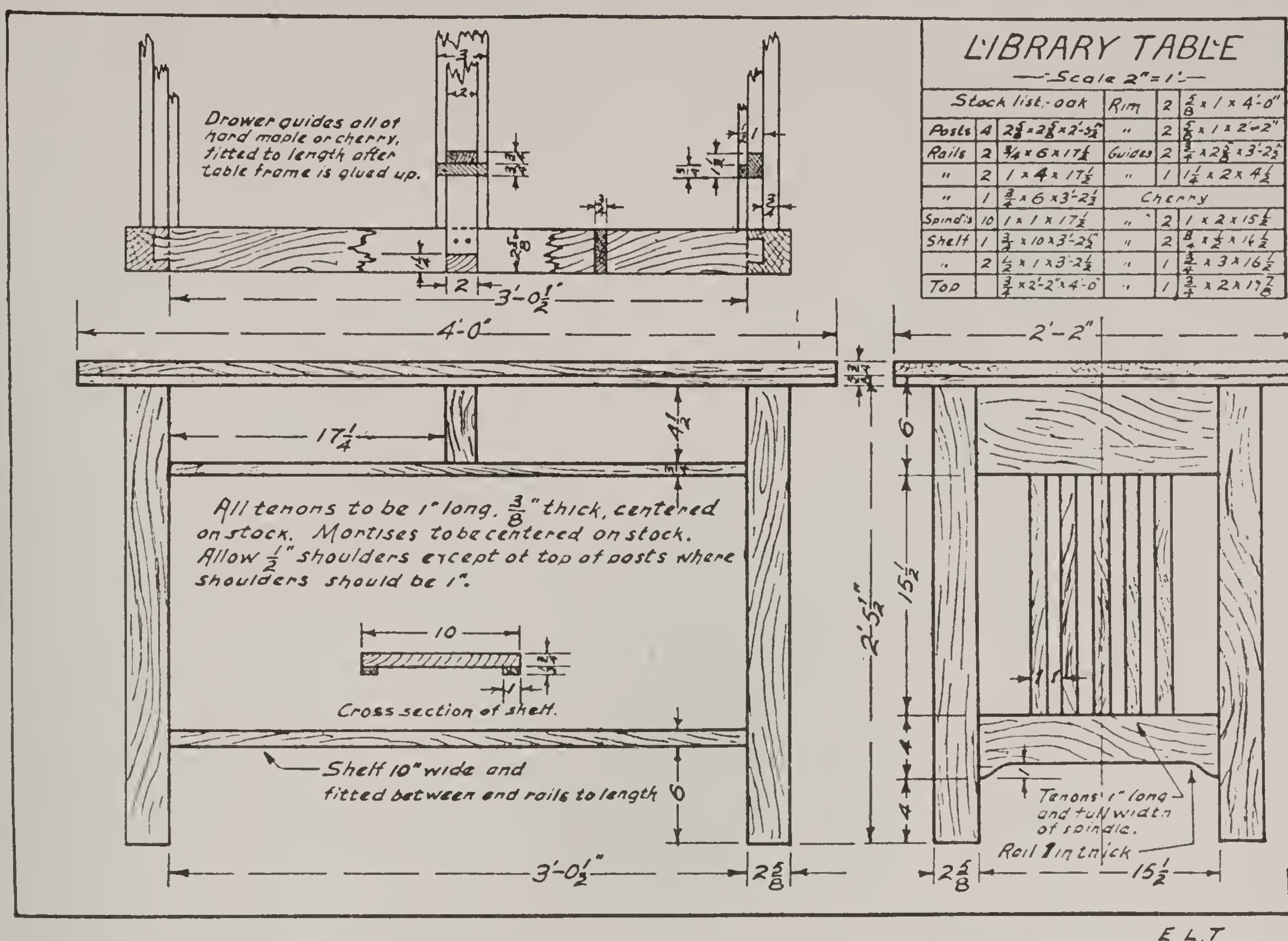


Plate XXVIII
PLAN 35. LIBRARY TABLE

smooth the ends of the top you will need to use the block plane, Fig. 37. Perfectly made and pinned joints are required between posts and rails. Fasten rails to top with table hinges. The legs are secured open by the spring board, which has two holes which must be very carefully placed near each end to receive pins in the under side of the rails.

Plate XX, Plan 27, is for a piano bench. This has all the essentials of table construction and makes a good project to do before under-

taking a table. The lower shelf may be mortised through the end rails or fitted between and fastened by first boring a ¾-inch hole from underneath, 1-inch from the end and not more than half-way through the stock. From the inside of this hole, bore with a 7/16-inch drill out fastened to the top of the side rail. Cleats are nailed to the inside of the rails about one-half inch from the lower edge and a thin wood or pulp board fastened to the underside of these cleats. A storage for music is thus provided.

The plate rack, Plate XXI, Plan

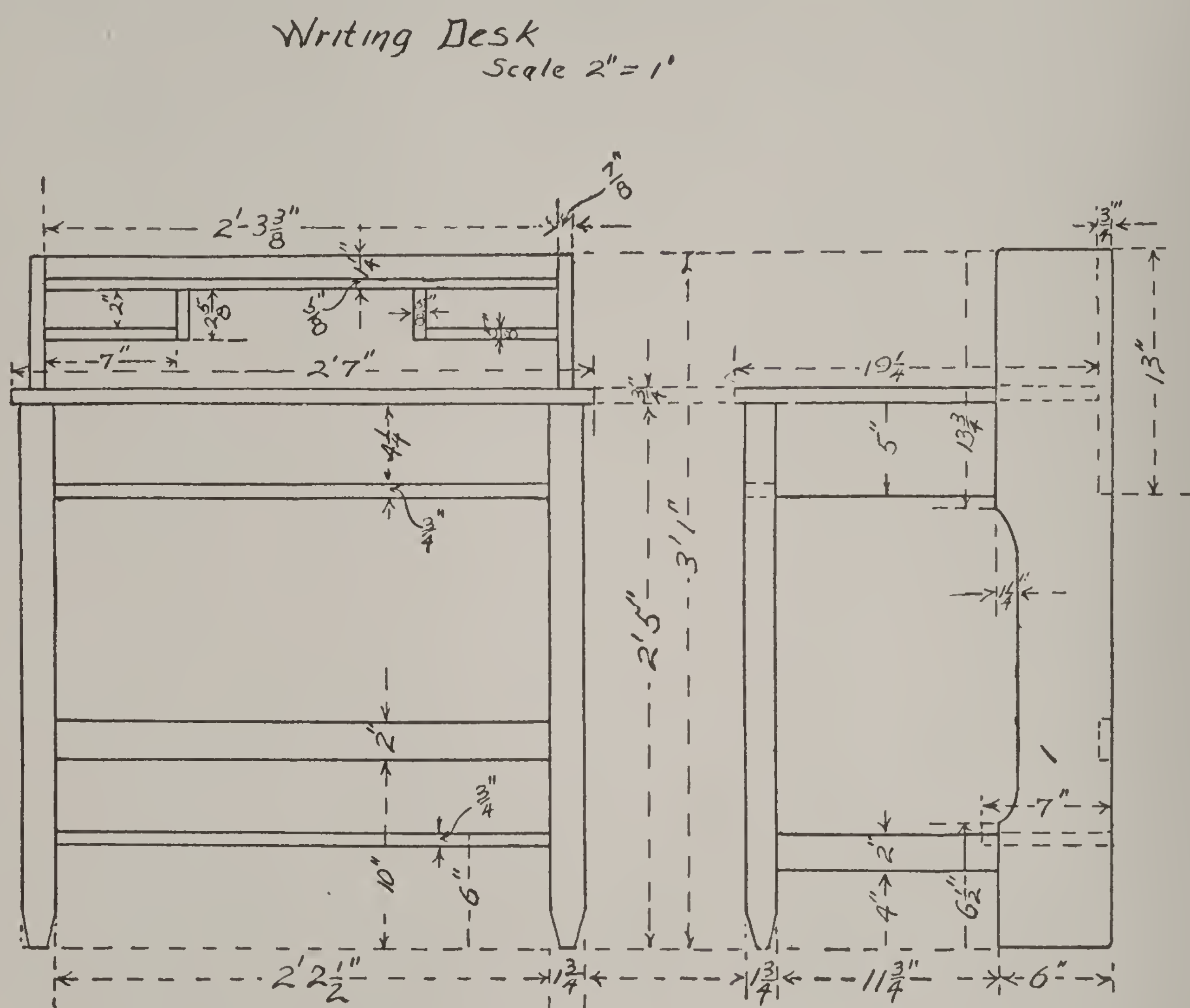


Plate XXIX

PLAN 39. WRITING DESK

Stock list, kiln-dried quarter-sawed white oak

	Inches
2 front posts	1¾ x 1¾ x 29
2 rear posts	⅞ x 6 x 37
2 upper side rails	¾ x 5 x 13¾
2 lower side rails	¾ x 2 x 13¾
1 back	¾ x 13 x 28
1 back rail	¾ x 2 x 28
1 shelf (lower)	¾ x 7 x 27⅜
1 front rail	¾ x 1¾ x 28½
1 top	¾ x 19¼ x 31
1 shelf (upper)	⅝ x 5¼ x 27⅞
2 pigeonhole ends	⅝ x 5¼ x 27⅞
2 pigeonhole shelves	⅝ x 5¼ x 7

Stock for drawers to be worked out from study of drawer specifications for writing table and cabinet, Plans 33 and 34.

through the end of the stock for a screw. Two screws will be needed in each end. Table tops are often fastened down to the frame in this manner. Look over shop-made furniture for hints. The top of this bench is put on with table hinges, 28, is a plain mortise and tenon job that at this point will need no comment, unless it be the general rule that in fastening with screws, e.g. the shelves, place them, as far as possible so their heads will be hidden from view when the piece of

furniture is in its normal position. Such a piece as this should be screwed firmly to the wall with two round-head screws located above the center of gravity.

The wall book shelf, Plate XXII, Plan 29, may be made without the panels, when it is much the same problem as Plate XXI, Plan 28. If made in this manner and the ends fastened to the shelves with screws or dowels, it presents no new problem. It may, however, be made the first piece of panel work as indicated in the drawing. Make the mortises and tenons first. Then with the universal plane set up for cutting a ¼-inch groove, make the grooves, centered on thickness and ¼-inch deep, on lower edge of top rail, both edges of middle rail, upper edge of lower rail, and inner edges of vertical end pieces (stiles). Make the panel a bit less in width than the space plus the grooves to allow for expansion. Glue ends of panels, but not the edges; if edges are fastened and the panel shrinks, it will split. Glue in a piece at top and bottom of groove in stiles.

The best construction would call for a housed joint where the shelves join the ends, i.e., the end of the shelf is "let in" to the end board its full size to the depth of ¼-inch. This is really only a very accurate mortising job, but to do it you will need a bit without a point so the boring can be done without defacing the outside of the end boards. Such bits are called Forstner bits, and ¼-inch, ⅜-inch and ½-inch are the most useful sizes.

The Morris chair, Plate XXIII, Plan 30, presents no new processes. Its dimensions may be changed to suit, those in the drawing being somewhat smaller than standard. Hinge the back to the back rail and have your local blacksmith make a rod of ⅜-inch round iron to support the back. Loose cushions are usually used in Morris chairs and slats should be provided, resting on cleats near the bottom of the front and rear rails, on which to place the seat cushion.

There is really no new work in the bookshelves or in the magazine holder, Plate XXIV, Plan 31, and Plate XXV, Plan 32, but great accuracy must be exercised both in measurements and in working. Cut the notches in the posts all to the same depth and be sure the ends of the shelves are perfectly square and all to the exact length required. End sections are glued up first, and all shelves and the members of the back sections must go in together. Slats may be nailed with finishing nails to the shelves.

Notice in Plates XXVII and XXVIII, Plans 33, 34, and 35, that the front rail under the drawers lies horizontally so that the mortises in the posts will be crosswise instead of lengthwise. Study Plan 34 for the arrangement of drawer guides. Plan 33 will show the best method of drawer construction. The ends of the front board have a rabbet into which the end of the side board is glued and nailed. A groove, run ¼-inch from the bottom of front and side boards, receives the bottom which is glued into the front board only. The back board fits in grooves near the back end of the side boards and rests on top of the bottom board. The bottom, if made of wood, will, of course, need to be glued up out of several pieces. It would be well to make it of ⅜-inch stock and thin the front and ends to fit the grooves. It is glued at the

front only and placed under the back board to allow for the variation in size that is inevitable with such wide stock. Where dimensions are not given, make the drawers to fit the space provided for them.

Fasten in bottom shelves and fasten down table tops as explained for the end of the brace bar on the piano bench, Plate XX, Plan 27.

Table tops should be squared to size, the underside planed to a flat surface, and then fastened to the frame. Plane, scrape and sandpaper the top after it is fastened down. In planing such wide and cross-grained surfaces, use a sharp smooth plane and go crosswise with a shearing cut. Oil the ends of the top to prevent the joints from opening and finish both sides of the top to prevent shrinking and swelling by shutting the air from the wood. Do not glue up a table top very long before the frame is ready to receive it, and finish it as soon as possible after you have it smoothed.

Plate XXVI, Plan 34, shows, in the detail for the small drawer, a dovetail joint. This is not essential but should you care to do it cut the tails first. You will find the T-bevel the tool to lay them out with. Bore a hole between them and use the back saw and chisel to finish the cutting. Mark the mortises in the ends of the drawer fronts from the tails, bore them with the Forstner bits. To get into the sharp corners you will need a chisel ground to "skew" point. A good dovetail joint is considered the test of an excellent workman.

Probably the best manner of fastening the cabinet together is by housed joints where the shelves go into the ends and the ends go into the top shelf, the back to be fastened on with screws and the whole screwed to the table from the under side of the top.

Now, my young friend, I bid you study carefully and build honestly. My mother often said to me when I was a lad, "First be sure you're right, son, then go ahead." I commend her advice to you. It is good in building these wooden things we have been talking about; it is even better in building that glorious thing called manhood. And if these pages of directions have led you to build well and joyously and to rejoice in the rewards of common toil, you will have built not only good and useful pieces of furniture but a substantial and beautiful part of that structure that men call character.

Pets and How To Keep Them

Furnished Apartments for Ants

ANTS are such little folks and have such interesting ways of building homes that we must make for them a special apartment to keep them alive and comfortable. To make an ant apartment, take a piece of plank 1¼ inches thick, 20 inches long and about 16 inches wide, and near the edge dig a furrow ½ inch deep. The plank should be painted, furrow and all, to keep it from checking. This plank is the yard around the apartment and the furrow is to be filled with water, making a moat to keep the ants in their little castle. For the apartment itself we must have a sheet of tin 11 inches square, made into a tray by turning up the edges all around, about

The Ant Castle and its Moat

$3/8$ inch. Place this tray in the middle of the plank and place on the bottom of the tray a pane of window glass 10 inches square to make the floor of the apartment. Place around the edges a few burnt matches to hold the ceiling up from the floor, and cover the glass with a thin layer of fine soil, and at one corner place a triangular piece of blotting paper about 4 inches long. Place over this, resting on the matches, another sheet of glass, 10 inches square, for the ceiling. But this ceiling must have one corner cut off so as to make a triangular door for the ants to enter. This door should be placed so that one corner of the blotting paper may be reached through it. After the ceiling is put on we must make the roof, which consists of two pieces of thin boards, each 5 by 10 inches in size, and each with a knob or a screw-eye at its center to lift it by. For we have to take off part of the roof each time we wish to see what the ants are doing.

How to Watch the Ants

In order to get some ants to live in the apartment, we must take a 2-quart mason jar and a trowel and go to some field and turn over stones until we find under one a colony of ants with plenty of young ones. These look like little white grubs or wheat kernels. With the trowel, lift the soil, ants, youngsters and all and carefully place them in the jar and screw the cover on, thus being sure that our captives do not escape until we get them home and empty the contents of the jar on the roof of the nest. The ants will soon find their way into the little apartment, and will carry their babies in there and hide them in the dark. This will happen in two or three hours, and then the dirt may be removed from the roof covers and the ants will be settled in their apartment.

A Moving Day for the Ants

We must remember that light disturbs the ants very much, so we must lift off only one cover at a time when observing; and we must not keep this off very long. Fresh food must be put on the plank each day, such as bits of hard boiled eggs, finely minced, lean, raw meat, any dead insect, or spider, bits of bread, broken berries and fruit, seeds of plants and grasses. The corner of the blotting paper should be wet with water from a pipette every second day, for thus the nest is kept properly moist. The moat must constantly be filled with water, or the ants will escape. In such a nest the ants may be seen making their toilets, feeding and caring for their young, talking by patting each other with their antennae and many other interesting things. They will always choose some corner into which they will dump the waste matter of the nest.

Helping the Ants Keep House

While it is desirable to have a queen mother in such a nest, yet a queen is so hard to find that we must usually be content with ant workers and their young. The ants will be very contented while they bring up their young.

Moss Gardens for Toads and Tree Frogs

Take an aquarium jar and place about three inches of gravel on the bottom, building up one side much higher than the other. Cover the higher side with moss, if you have it, or plant some ferns in it, or leave it bare. Pour in enough water, carefully, so that it will cover the lower

A Cousin of the Toad

Bull-Frogs make known their presence in every pond and quiet lake by their deep-voiced bass chorus, but how many of us ever saw one of these interesting animals at close range? This you can do if you keep them for pets.

part of the gravel, but will allow the higher part with the moss to project above, so as to make land for the toad to live on. There should be as much land as water in this little toad garden. This is necessary, for the only way a toad can drink is by getting into the water and letting it soak into its skin. There should be a cover of wire netting, fitting firmly upon the jar, so Mr. Toad cannot hop out. The moss garden must never be placed in the direct sunlight; and if it becomes smelly, the gravel should be washed or renewed and the garden made over.

Then Drinks Through His Skin

The toad should be fed twice a week. Flies caught in a wire trap and held in water for a moment may be emptied into the garden, so that the toad can take his breakfast food in his own way, which is a very interesting way. Mr. Toad's fork is his tongue, and instead of having tines, it is sticky, like tangle-foot fly paper. It is fastened to the front of his mouth, so that he can dart it out and stick it fast to a fly and pull it back "quicker than a wink." The toad also likes meal worms and earth worms, and with a little patience he can be taught to take bits of liver from the point of the forceps.

Needs Only Two Meals

You can see many interesting things about your toad in a moss garden. Its warty back looks just like the soil in the garden where the


The "froggie who under a toadstool sat", conventionalized, makes a fine black-board border for the school room. This is how it is used by New York State teachers in connection with the State Department of Visual Instruction.

toad loves to hide. Its eyes are beautiful, and it has tiny nostrils and a circular, flat ear just behind each eye. Its throat beats to help it breathe. Its strong jumping hind legs have feet with five toes, which are partially webbed. Its short arms have hands with four fingers. It is fun to see the toad bury itself in the ground or swim in the water; and, most of all, it is fun to see it swell up with enjoyment when you scratch its back with a straw.

His Throat Beats to Help Him Breathe

How to Care for Tree-Frogs

The moss garden is just the place in which to keep a dear little tree-frog. Only we should add to it a bit of a branch covered with bark for the tree-frog to perch upon. This froglet is the most fascinating of all frogs to keep as a pet and to watch. It is a tiny creature, with beautiful eyes and knowing ways. It has a little round disc on each toe, which is covered with a sticky substance that helps it to hold on to the bark of trees, where it naturally lives. It is a wonderful musician; its little throat will swell out until it looks as large as a marble, when it is making its sweet but stirring song.

Mr. T. Frog and His Funny Feet

The tree-frog, like the toad, finds a cage full of half drowned flies most diverting hunting. It also is partial to meal worms. Bits of liver at the tip of forceps, if held enticingly in front of a tree-froggie's nose, suddenly disappear.

How to Keep a Squirrel "Squirrelsome"

Squirrels are such active creatures that it is wicked to keep one cooped up in a small cage, even though there is a wheel in which it can play. If possible squirrels should be given their freedom out of doors; they will become very tame by regular feeding, and thus make charming pets. If this is not possible, a big cage, at least six feet square is necessary; it should be made of chicken wire ½ inch mesh. Near the top, at one side, should be fastened a nest box about one foot square with an opening 3 inches wide near the top. Dry leaves and grasses are to be used to make a bed in this box. Branches should be placed in the cage so as to give the squirrel a chance to leap and play. A wheel may also be added for the little captive's amusement. It may be coaxed into the wheel by placing in there a few nuts. A squirrel may also be kept comfortably in a room, but care must be taken lest it gnaw its way out. A nest box is as necessary in a room as in a cage.

Make a Home Not a Treadmill

Squirrels should be fed plenty of hard shelled nuts, like walnuts, hickory nuts and butternuts, so that their

The Saucy Little Gray Squirrel

Squirrels are such active creatures that it is wicked to keep one cooped up in a small cage. If possible, they should be given their freedom out of doors; they will become very tame by regular feeding and thus make charming pets.

teeth may be kept from growing too rapidly. They are fond of chestnuts, acorns and will even eat peanuts. They are also fond of berries, lettuce, corn, bread and milk, bread crusts, and many kinds of breakfast foods. Lumps of hard plaster must be kept where the squirrels can have access to them; and every day there must be fresh water supplied in a dish which it is impossible to tip over. A baby squirrel may be fed luke-warm milk from a spoon.

The Food Squirrels Like Best

How to Make Bunny Comfortable

Bunny's house must be made so that it will keep him warm and dry, and at the same time, just like little boys and girls, he must have plenty of fresh air. Bunny's house is called a hutch, and in size it should be at least a yard long, 18 inches wide and 18 inches high. The roof must not let in a drop of rain or of melting snow. One end should be very tight, so that there can be no drafts; in the other end, there should be a door. At the end farthest from the door, a little bed chamber should be partitioned off. The floor of the hutch should not rest upon the ground, and it should be carpeted with a layer of sawdust and above this a layer of clean straw or hay. The sawdust in the outside room will need to be replaced daily with a new supply. Bunny is very careful of his bedroom, so the bedding there need not be changed so often. The hutch should be placed in a yard fenced with chicken wire, which must be set into the ground to the depth of a foot; otherwise Bunny will burrow out. If the yard is small it may be roofed over; and, if several bunnies are kept together in such a yard, each should have a little house of its own. A yard to run about in is almost necessary for Bunny's health, since he needs to take exercise.

Building the Hutch for the Rabbits

There are so many things which Bunny likes to eat that we can al-

Pet Bunny and a Baby Chick

This nice, white bunny had his picture taken. I wonder if you could guess from the picture what day it was when he had it taken. Bunnies are such dear pets, they are so soft and warm and have such queer, long ears and such squirmy, pink noses.

ways set his table to suit his taste. He likes cabbage leaves, sliced beets, parsnips and carrots. If he can have all of the sliced carrots he can eat he will always be well. He likes fresh grass, dandelion leaves, lettuce and parsley. He also needs dry food, and is fond of good clover hay; this should be used for his bedding so that he can eat up his bedspread at his leisure. He also likes oats, bran and meal, which should be dampened enough to be crumbly.

What Bunny Likes for His Meals

Bunny's table should be a pan with its edges turned in so that he cannot pull his food out. His pan should be washed and scalded two or three times a week. He must also have fresh water every day in a drinking pan fastened to the side of his hutch, so that he can drink without spilling the water. The drinking pan must be cleaned often.

If Bunny is troubled with diarrhea, give him dry food instead of green food. If he takes cold and looks as if he needed to use a handkerchief, his nose should be bathed in warm water once or twice a day so that the mucus will not dry and stop his breath, and he should be given a warm bath and some hot milk. If we need to move Bunny we must never lift him by the ears as if they were his handles. We may take him by the ears with one hand but always bear his weight from below with the other hand.

When Bunny is Under the Weather

Mama Bunny should be given a home of her own apart from the others, when a litter is expected She will make a comfortable bed for her bunnies out of hay, and will line it with soft hair which she will pull from her own breast. After the baby bunnies come, she should not be disturbed for a few days or she will lose her mind and destroy them.

What to Do When the Babies Come

When she leaves her nest to go out for food, we can take a peep at her little family. Baby Bunny is born blind, and scantily dressed in silky fur. After nine days its eyes open and by the time it is a month old it will hop about "lippety, lippety," and then may be fed bread and milk, which Mama Bunny will also enjoy. Later, fine bran mixed with carrots, or dampened oatmeal will be relished by the little bunnies. They should be taken away from their mother when they are two months old, and all of the little girl bunnies should be put in one pen and the little boy bunnies in another pen, quite separate.

Gold Fish and the Aquarium

Go to the nearest pond or quiet stream where water plants grow, and in a pail of water bring home several of these plants which live their whole lives below the water surface. Place in the bottom of the glass aquarium a layer of sand and gravel an inch or two deep, and then carefully set in this sand the water plants and anchor their roots by placing little stones on them. After this is done, add water by pouring it from a pitcher very gently down one side of the aquarium so as not to uproot or disturb the water garden. In such an aquarium the water is kept pure by the growth of the plants, so it will not need to be changed more than once a year, when the aquarium will need a thorough cleaning. Fish or other water creatures may be kept comfortably in this aquarium, which should never be placed in the direct sunlight, but as near to a north window as possible. A dip tube should be used to remove waste material from the bottom.

A Bluebird House

This little boy and his sister had a garden, but the worms and bugs ate the young plants in it most greedily. So they decided to build a bird house as an invitation to the bluebirds to come and eat up the bugs. Here you see them putting up the house in a corner of the garden.

Gold fish may be kept very comfortably in such an aquarium. They may also be kept in an aquarium where there are no growing plants. If a fish globe is used, it should never be more than half full of water, so that there will be as much water as possible in touch with the air. If the globe is filled to the brim, the poor fish will suffocate. The gold fish aquarium should never be placed in the direct sunlight; the water in it should be changed at least twice a week and great care must be taken to have the fresh water of the same temperature as that which is emptied out. If rice water is fed to the fish, the water must be changed three times a week. When changing the

water, take the fish out carefully by hand or with a little dip net, and place them in a basin of fresh water while the globe is being cleaned.

The most common cause of death of gold fish is over-feeding, for they require a very small amount of food. Two kinds of food should be given, ground fish or other animal food, and rice water, oatmeal, or flaked vermicelli. Bread or anything with yeast in it should never be given. Gold fish should be fed every day at a regular hour and only a small pinch of food for each fish should be given. Pond snails, newts and turtles should never be kept in an aquarium with gold fish.

Feeding "Old Bobbie"

"Old Bobbie" was a robin that came to this same window sill four years in succession. Two small friends of his are offering him breakfast, as you see.

How to Raise Pigeons

These lovable birds must be kept in a house which is rat and mice proof. If they are kept in a dove cote, a guard of zinc should be bent down around the base of the standard which supports it, so the rats cannot climb up. If the pigeons are kept in a house such as is used for poultry, it should have an interlining of wire netting. The nest boxes should be about a foot square with a threshold outside of each for one parent to perch upon while the other is sitting on the eggs. The whole pigeon house should be occasionally whitewashed, outside and in, with lime.

Pigeons should be fed twice a day. They are fond of red wheat, Canada peas, buckwheat, hulled oats, kaffir corn and millet; as a treat once in a while, the seed of rape or hemp may be given. Barley, rye and large kernelled corn should never be offered. To keep the pigeons well, they should have green food, such as lettuce, onion tops, etc. They also need salt; a large lump of rock salt, moistened, may be placed where they can get at it any time or salt

An Interesting Pet

This bird looks as though he were angry, but he is not. He is a ruffled grouse—a kind of partridge—and his feathers just grow this way. The father of the little girl in the picture raised him from the egg. He is quite tame.

codfish may be tacked to the wall where they can nibble it. Gravel is quite necessary to the pigeons' digestion, but if they are free to fly they will get it themselves. If they are confined in a yard of chicken wire, they should be given crushed oyster shells mixed with sand and charcoal. They must also be able to get a drink of fresh water whenever they desire. If they cannot be given access to running water, fresh water should be placed twice a day in shallow pans in their yard. A pigeon does not act when drinking like any other bird. Did you ever notice this difference?

How the Mother Feeds Her Babies

Seventeen days after mother pigeon lays her eggs they hatch into very awkward looking little squabs. But the parents think they are the most beautiful babies in the world and feed them with a food which is produced in their own stomachs. After five days the parents give them grain which they first soften in their stomachs. A squab is fed on pre-digested food in this way until it is five weeks old.

How to Care for a Canary

Andy is a Hartz Mountain singer with red bracelets on his legs as a tag for his pedigree. He has a wonderful song which he learned from a flute and when he sings, he lifts up his head so as to give his lungs room and his notes bubble out of his throat.

What Andy Does All Day

As soon as the cover is taken off his cage in the morning, he stretches, then hops down to get some breakfast from his seed dish. After that he begins calling for his bath. He is very fond of his bath tub. For, like all imported birds, he will use only an outside bath, which is a zinc bottomed box with three sides and sloping top of glass. The open side is hooked on to cover the open door of his cage, thus giving him a little glass "bay-window" for a bathroom; and although he may splash around in the water a great deal he does not wet his perches or the bottom of his cage. After his bath, Andy is let out of his cage for an hour or two in a room with screened windows; he loves to fly around and explore everything he can reach. If his master or mistress enters the room he at once begins to beg for hemp seeds which are kept in a basket on the bureau; he loves hemp seeds so much that he will come and take them from the fingers, and can be coaxed to do almost anything by giving them to him as reward. However, he is allowed only a few hemp seeds a day.

What Andy Has to Eat

When it is time for him to return to his cage, fresh water is put in his drinking cup and fresh seeds in the seed dishes. He watches attentively while this is being done and at once goes into his cage to feast. Fresh lettuce leaves are placed in a glass of water which in turn is placed in the bathtub which has been emptied and again hung over the door of the cage. This is a way to keep the lettuce fresh for hours. Fresh leaves of lettuce, chickweed, cabbage or slices of apple are quite necessary to the health of a canary. Andy's seeds are a mixture for "roller canaries," which means that plenty of the seed of summer rape, which is brown and not black like mustard seed, is mixed with canary seed and millet. If Andy were an English or American

Queer Companions

Here are a rose-breasted grosbeak and a young toad, both pets of the little girl who is holding them.

canary, he would be given less of rape seed. He is given a teaspoonful of seed each day and all his dishes are emptied and cleaned often. Occasionally he is given a bit of dry cracker for a relish; and he always has sand on the bottom of his cage and a cuttlefish bone is wedged into the wires at the top, so that he may eat of either and keep his digestion in good order.

Andy's perches are not all of the same size. Three of them are ½ inch in thickness and taper toward the ends; two are not more than ⅜ inch thick and thus his feet are never tired. His cage is 10x14 inches. A canary cannot be kept comfortable in a cage smaller than this. The cage and its perches are cleaned at least three times a week, and oftener if necessary. The perches are dampened, cleaned and thoroughly dried before they are put back. Damp perches would give Andy rheumatism. Andy loves to have his cage near the window where he can see what is going on out of doors, but it is never hung directly in the window. It is either suspended from a hook or placed on a stand so that it may be far enough from the window so he will not be in a draft which might give him a

Three Little Homeless Babies

The nest in which these little chebecks were hatched and reared was blown down. The little girl picked them up from the ground because she was afraid a cat or dog would kill them. A few days later, when their wings were stronger, she put them back in the tree and they were able to keep out of danger.

Two Bird Invalids

In the basket, being fed, is a fox squirrel that bumped his head on a wire and was hurt so that he was not able to take care of himself for a few days. A cedar bird is perched on the little boy's hand. He has already had his dinner. A cat attacked him but he managed to escape from her, though his wing was badly hurt. Dolls take second place where pets are concerned, you see.

Some Bluebird Orphans

The bluebirds, that came to live in the bird house in the garden, deserted their four children during a long, cold rain storm. The hungry little ones would surely have starved if they had not been cared for by the children. After being fed until they were grown up, they were quite tame and often came to the children to be fed and petted.

cold and spoil his voice. His cage is never placed in the direct sunshine except for a few minutes after he has bathed, when he loves to fluff his feathers and take a sun bath.

Andy is usually let out of his cage for two hours again in the afternoon. As soon as it is dark he retires to his swing and his cage is covered with an envelope of thick wrapping paper which fits closely around the bottom of the cage, but is open on the top. Then he tucks his head under his wing and fluffs out his feathers so that he is just a little yellow ball, and falls asleep.

Last summer, Andy was a very dumpy, silent bird, for he was shedding his feathers; this is as hard for a bird to endure as is measles for a child. During this period he was given, in addition to his other food, the yolk of a hard-boiled egg chopped finely with an equal amount of cracker crumbs and a liberal sprinkling of cayenne pepper. His cage was hung in a warmer place and we never scolded him because he did not feel like singing.

"Poor Birdies !"

The mother robin was killed by a cat and the young ones would have suffered the same fate if they had not been rescued by tender-hearted Roland.

Pretty soon a mother bird will come to live in the room with Andy, and they will have first some pretty eggs and then some baby birds. The nest will consist of a tin strainer about 3½ inches wide lined with cotton and covered with cheesecloth, which will be sewed smoothly around the edge of the nest. Both birds will be fed on hard boiled eggs mixed with stale bread, in addition to their seeds and green food. Fourteen days after they are laid, the eggs will hatch and Andy will think those little bare, scrawny, blind birdlings are the most beautiful creatures in the world.

Please Tell it Again

The Art of the Story Teller

The Story Hour

DO YOU remember teasing for stories when you were a boy or girl? You can well believe that you must have done so when

Can You Serve a Story Meal?

you think how many nonsense rhymes, fables, fairy tales and hero stories you know. And perhaps you now have a little man or maid in your house, a room full of eager children in school, or a stream of them coming to you in a library, to remind you of this universal demand of childhood. But that children need stories for their full mental and moral development is a recent discovery of Child Study.

As to what stories they need, it was the children themselves who directed the attention to old favorites. There are classics of

Little Miss Hood and Other Friends

which the little folks never tire. "Tell it again" they say of the Mother Goose rhymes, of Aesop's Fables, of such rythmic narratives as The Three Bears, and of such fairy tales as Sleeping Beauty and Red Riding Hood. These stories are loved because they really are the best that the world has ever had to offer, the slowly gathered and precious culture of ancient peoples of East and West.

Legends, Epics of History for Older Children

Nor did we think that, beyond this folk lore, there was a vast body of legend, epic tale and history, story of even greater cultural value, that was actually being withheld, to the infinite loss of the older children who were supposed to have outgrown their love for stories. When the child went to school he had a dull uninspired reader by anonymous writers, as if to read were an end in itself and not a means, and all his other text books dealt with figures, names and dates—colorless facts. Craving life, adventure, romance, the adolescent boy graduated into Diamond Dick and Jesse James, the girl into the Elsie books and silly love stories. Not until the high school age—and nine-tenths of the children never go to high school—were they brought back into a contact with the world's great literature. By that time their taste was perverted.

Why Children Read Harmful Books

"The Legend" — *Painted by George Paul Chalmers of the Royal Scottish Academy*

Here is a group of Scotch children listening to an old Scotch woman telling one of the numerous legends in which the history of Scotland abounds. Did you know that from such native story-tellers the boy who afterward became Sir Walter Scott, one of the most famous story-tellers of all time, learned many of the tales and legends recorded in his delightful works?

The Great Story Telling Movement

In recent years experiments have been tried, in the school room, public library and social settlement home to put life into geography and history lessons, to improve children's taste in reading and just frankly to add joy to the sordid lives of the poor, by story telling. In a country school house a teacher told the stories of the Hiawatha cycle and re-created the red world of America. In Hull House, Chicago, boot-blacks, "newsies" and "little mothers" with big babies, fol-

Stories In Libraries And Other Public Institutions

lowed the careers of King Arthur and his Knights for many weeks, until a boy ran out crying that the "good king" was dead! In libraries, children doubled up with laughter over the comical negro yarn of The Tar Baby, or followed with breathless interest the voyage of Jason for the Golden Fleece; and they went home with Uncle Remus or Hawthorne's Wonder Book.

Teaching Story Telling

Then—all at once, it seemed—normal schools and kindergarten and library colleges had courses in the theory and practice of story telling. Ancient and modern classics began to be ransacked for material, by trained writers and educators, and publishers vied with each other in putting the tried and true-blue stories into usable shape for the story teller and the children.

Revival of the Story Teller's Art

Best of all the art of story-telling has been revived. We all know that some people tell stories better than

An Art for Every One

others. It is a social asset everywhere, and of which mothers and teachers are the chief inventors; a gift that, like singing, writing and painting, can be cultivated. Training in the art involves a study of the psychology of childhood; a knowledge of sources, of dramatic expression and control of the voice, and an opportunity to hear good models. Practice must be had also to learn, each his own capabilities—what kind of stories he tells best.

Effect of Stories in Character Forming

The power of the story to influence conduct always has been understood and consciously used by the world's religious and political leaders, as is illustrated by the hero stories of the Old Testament and the parables of the New. With the close

Question of Material and Method

study that is now made of the effect of stories on character formation has come a new sense of responsibility. "A story," told in any way, will no longer do. "What story?" is the question and "When?" and "How?" What story should be told to any particular child or groups of children at a given age? Are they four years old, or ten or fourteen? What are their interests? Are they of American or foreign birth? Do they know and love animals? Are they city or country children? What sort of people do they admire and try to imitate? What do their lives lack of practical experience and mental and moral stimulus?

Why Primitive Stories Interest Children

Broadly speaking, every child repeats, in his growth from infancy to manhood, the experiences of the race. In the classical rhymes, fables and tales that have perennial charm are preserved the ideas and ideals of nations at every stage of their development. The jingle and non-

Why Nonsense Rhymes Attract

sense rhyme grew from a crude sense of music and of humor, and they tickle the fancy of the smallest children who are in the primitive stage. It is exciting and funny, but not absurd, that the cow jumped over the moon and the little dog laughed. A baby cries for the moon thinking it within reach. His toes are playmates readily conceived as little pigs—papa's foot is the cock-horse going to Banbury Cross; Santa Claus and brownies and fairies are real people. Before these nonsense rhymes are exhausted, a child is ready for The

House that Jack Built, The Three Bears, The Little Pig that Wouldn't Go Over the Stile, and other rhythmic stories. These narratives consist of a few familiar elements touched with mystery. They are all action; each event is a complete image, and the repetition knits the incidents together, relieving the strain on attention. The child finds the same pleasure in the recurrence of a phrase or sentence that a grown person feels in the recurrence of melody in music.

Why Children Like Repetition

Before a child enters the kindergarten he should know the nursery favorites that can be had for a few cents, and with gorgeous illustrations, in any book store or toy shop. He should know such fables as The Lion and the Mouse, and The Tortoise and the Hare, and should have learned to laugh at such humorous stories as The Greedy Cat and The Wise Men of Gotham. Little children need to have their taste in fun cultivated. The comic sections of newspapers with alleged humorous deformities, trickery, vulgarity and impudence, should not amuse them.

Good Humor—Not Cruel Humor

A funny story belongs to every age. It is a sad world to one who cannot laugh; an inhuman world when it seems funny to see a dog tormented with a tin can rattling at his tail, or a passer-by injured by a slip on a banana skin. And children who have never laughed with Uncle Remus, or known the comic animals of The Jungle Book or the delightful absurdities of Alice in Wonderland, will hardly be able to appreciate Mark Twain and Don Quixote and the great comedies of the drama.

Good Stories are Good Teachers

There are, of course, thousands of funny stories—good, bad and indifferent. Story tellers should draw from all sources, for the folk-lore of each people reflects their racial characteristics. They introduce children to strange people and far-away places sympathetically, and pave the way to understanding of geography, history and literature. The code of ethics of the good fairy story is sim-

Where the Good Always Triumph

Cinderella

ple and strong—good always overcomes evil. A typical one is that of the gentle and loving girl, whose beautiful lips dropped pearls when she spoke, while the ill-tempered, selfish one's mouth dropped toads.

Old Stories that Need Editing

But a few of the favorites need modification. For obvious reasons the cruel step-mother should be omitted from Cinderella. In Red Riding Hood the wolf is no longer allowed to eat the grandmother. Indeed, the dear old lady is clever enough to outwit him by crawling under the bed.

When Your Baby Meets the Fairies

Fairy tales, with their wealth of color and incident, cultivate the imagination. Without imagination, human beings are "dull, driven cattle," without joy, initiative or invention. Without it no one could build a house or furnish it, design an engine, get a dinner or make a dress. And fairy stories have come to be treated with vast respect since it has been discovered that childhood's classics have found place in epics and have been given new form in modern poems and paintings. The adult finds the Sleeping Beauty again in lyric by Tennyson and in Wagner's opera of Siegfried. Aeolus and the Bag of Wind, the college youth finds in The Odyssey. Other stories of unknown origin and no special honor refuse to die, and chance illusions to them call up vivid images—Aladdin, the splendid East, The Ugly Duckling, the cold North. In libraries, fairy stories are characterized as "non-fiction," for they were not invented, but grew as naturally as trees. They are the star dust of old mythologies—crude poetic attempts to explain the universe by prehistoric peoples. A few fairy stories of merit have been invented in Modern times, but compared with the old ones they have small vitality.

The "Star Dust" of Old Mythologies

The Mission of the Myths

The Greek, Norse and Indian myths should be given to a child as early as he can grasp them. The myth is, as one writer puts it, "The Voice of a people calling on God." It, too, is the story of explanation of the universe before natural laws were understood. In myths is the daily glory of the sun, the wonder of water and fire, frost and storm, plant and animal life. So many of them are stories of flowers, birds, rivers and animals, they awaken in children a love of nature and quicken their observation. The sun is the chariot of Apollo, the moon, of Diana, the rosy dawn, the garment of Aurora. Under a volcano is the forge of Vulcan. Neptune rides the stormy sea. Thunder is the bolt of Jove or Thor. A child can understand the story of Arachne the spinner, and get some notion of the amazing cleverness of the garden spider. He can learn the useful lesson of curbing idle curiosity in listening to the story of Pandora's Box, and the pleasures of hospitality in The Miraculous Pitcher.

Explaining the Wonders of Nature

The Greek and Norse mythologies furnish stories of great variety, but the American Indian and Negro myths are more primitive and have an earlier appeal. The stories of Uncle Remus are nature myths. Many of them originated in Africa, and they are a pathetic revelation of the unresisting black race, as timid and

Indian and Negro Myths

helpless as Br'er Rabbit. The shifts and craft to which the animal is put to outwit his foes, inject sympathetic understanding into the race question. But he makes no maudlin appeal, and for pure fun there are no better stories. The childish ideas, the dialect and the quaint charm of ingenuousness are inimitably humorous.

Hiawatha is our epic of the red man—the single example of an epic of modern invention. It lives because it is based on the genuine myths, legends and traditions, and in form it is primitive, being modeled after The Kalevala, the Finnish Epic—rhythm and repetition without rhyme. Its pictures of wild American life, in the forest and by the stream, its love of nature, its religious ideals, and its heroism are authentic. And the cycle of stories is in the true epic style, grouped around the birth, life and death of a national hero. No other story in literature is so well fitted for use with a great number of young children. In the school room it may be made the basis of months of work in oral and written English, in drawing, modelling, history, geography and, finally, of dramatic representation.

Wide Interest of the Hiawatha Stories

The Epic Compared with the Fairy Tale

The stories of Ulysses, Beowulf, Siegfried, King Arthur and Roland come later. These legendary cycles form the link between the myths and history. The epic has all the good qualities of the fairy tale, plus the continuity and completeness of biography. King Arthur's life is as full of action and as romantic as that of the hero of a dime novel. It is a "continued in our next" story that may run through the story hour week after week, and may be divided into chapters, each one complete in itself but exciting interest in the next. In a small park library in Chicago, nearly a hundred boys left the skating pond to listen to the spiritual adventures of The Quest for the Holy Grail. The Round Table stories are usually told in logical order: The Coming of Arthur, Launcelot and the Giants, Founding the Round Table, The Knighting of Sir Tor, Gareth, The Kitchen Boy knight, The Holy Grail, Sir Galahad, Launcelot and the Tourney, Launcelot and Elaine, Enid and Geraint, the Last Great Battle and The Return of the Sword Excalibur, Guinevere at Amesbury.

Striking Example of the Spiritual in Boys

When All Boys Are Knights

This is a model for telling all the epic stories. Ulysses, Beowulf and Siegfried interest children as young as ten, but Arthur comes later. He is the British hero of chivalry and Roland is the French. In the early years of adolescence every boy is a knight. He admires both physical and moral courage. Robin Hood and his merry men in Sherwood Forest also captures the boy of this age and there is great value in the attractive pictures of out-of-door life and manly sports, and fine literary standards in the old ballads, but these things are off-set by making a hero of an outlaw. The story should be given later in the adolescent period when young people can be interested in studying the historic setting—the abuses of a time that preceded, the conditions that produced such a redresser of the wrongs of the poor, and made of him a popular hero.

And Girls Like Knightly Deeds

Robinson Crusoe

Special Appeals to Girls

Up to a certain age, the same stories appeal to both boys and girls. There is no sex in the arts. But since men are the chief characters in the great stories, pains should be taken to emphasize the part that women play. Penelope, Brunhilde, Maid Marian, Elaine, Enid, Lynette, Minnehaha, should be impressed as important personages on both boys and girls. And the girls have their own epic heroine in Joan of Arc, and many a notable figure in myth, legend, history and fiction. There are St. Elizabeth of Hungary, Molly Stark, Jeannie Deans, Juliet, Portia, Florence Nightingale, Grace Darling and other heroines whose deeds inspire.

Heroines of History and Fiction

Introduction to the Love Story

When sex feeling awakens, it should have proper recognition in stories of noble and romantic love, such as those of Dante and Beatrice, Jacob and Rachel, Romeo and Juliet, Lincoln and Anne Rutledge, Enoch Arden, Evangeline. Such stories that dignify love will help young people to get safely over the silly period. This phase of adolescence is helped also by stories of Moses, David, Joseph, St. Paul, Luther, St. Francis of Assisi, Father Damien and other religious heroes, and in introducing the young people to Dante and Milton; for this emotional period is the one in which religion most strongly appeals.

Love Stories and Adolescence

True Stories of Men and Nature

To tell history stories one need not wait until children begin to question: "Is it a true story?" But just as soon as the question comes, the children are ready for the true nature story and the historical tale dealing with authentic characters. Now, there are many scientific accounts of the habits of animals and many fascinating stories of animals, but there are few accurate studies of animal life that are, at the same time, tellable stories. Aesop is not scientific,

Place of the Animal Story

nor is Uncle Remus nor Black Beauty, yet all these are valuable. The main purpose of the animal story is to foster a sense of intimacy and brotherhood with lower life. Ernest Thompson Seton's sympathetic studies are in the best form for the story teller. So are Kipling's Jungle Book and the works of G. C. Roberts and William Long. In the books of John Burroughs and Olive Thorne Miller is much material that can be adapted by the clever story teller. Besides Rab and his Friends and other dog stories of Dr. John Brown, and Ouida's Dog of Flanders, there are a number of collections of true dog stories. The point is that the boy who can be brought to like intimate peeps into animal life will graduate into an appreciation of Burroughs, Thoreau and good old Isaak Walton. And he will not torment cats and dogs nor rob birds' nests.

Some of the True Dog Stories

Stories About Historic Personages

Of true histories, there is an embarrassment of riches. A great number of them, such as that of Whittington and His Cat, Bruce and The Spider, William Tell and The Boy Who Saved the Dyke, are half legend, but are stories of historical persons and, like that of Washington's hatchet and Captain Smith and Pocahontas, they refuse to die. Every one of them bears a moral lesson so simple and strong that very young children can grasp them. As with the legend, the history stories that are told to children should be full of adventure and the spirit of youth. The lives of Franklin, Jefferson and Goethe are inspiring to grown people, but immature minds cannot appreciate such quiet lives.

Stories That Are Half Legend

But they can understand stories of high ideals, moral courage and deeds of great human service, so these qualities are brought out in action, and that without using the swash-buckling military conqueror. "Who was Alexander, pa, that people call him great?" the child asked in the old poem. He was much more than a fighter, to be sure, as were Caesar and Napoleon, but a child cannot understand constructive statesmanship, and history does not present the lovable human side of these world subduers as it does of King Alfred, Joan of Arc and Washington. The very best of all statesmen and patriots to give the child is Lincoln; the best modern military hero, "Chinese" Gordon. If Gordon had lived in the old days he would have been the hero of an epic, so varied and splendid were his adventures and deeds; so noble his character, so heroic his death. Lincoln is the one true epic figure that has been produced by our brief history.

Danger of the Military Hero

Explorers, Pioneers and Heroes of Invention and Service

Of explorers, Columbus towers above all other heroes, and LaSalle and Sir John Franklin are appealing figures; of patriots, the story teller may well choose Nathan Hale and Arnold Winkelreid; of backwoodsmen, Daniel Boone, Audubon the bird lover, and Johnny Appleseed, the pioneer orchard planter; of pathfinders, Lewis and Clark and Zebulon Pike; of naval fighters, Paul Jones, Farragut and Nelson. But it must not be forgotten that there are heroes of science, invention, the arts and industries,

The Child's Heritage of Heroes

literature, philanthropy and mercy —Davy, Watt, Moore, Thorwaldsen, Beethoven, Tolstoi and Stevenson, Florence Nightingale, Palissy, Father Damien. Stories of heroic policemen, engineers, firemen, wireless operators and health officers have been collected and are now a part of the study of civics.

Work of the "Story Lady"

Outside of the folk tale, that time has stripped of superfluities, there are few stories that are in just the right form for telling orally. A good "story lady" will analyze any story, reduce one too long, amplify one too short, gather from other sources local color and detail that is lacking, cut out tedious descriptions and unnecessary people and incidents.

As no singer sings all songs equally well, so a story teller must, by watching effects, learn her limitations. A good rule is that she should never tell a story in which she herself is not interested. She should feel its fun, its pathos, its nobility, and laugh and shed tears with her audience. Then she should face a half circle of children, if possible, and tell her story simply, directly, dramatically, with zest as "little orphant Annie" told her stories. Children should never be talked down to. They follow a story that is far beyond their ability to read. Nor should the moral be pointed out. In a really good story the moral will take care of itself. The test of success is a big-eyed audience listening with breathless interest—then a long-drawn sigh of happiness, then a "Please tell another one!"

Personal Interest is a Guide

If well told, in school, the children will always want to talk about a story, write about it, draw, paint and model it, dress up and act it, ransack reference books to find out more about it, live it. In Forestville School, Chicago, the children have for years presented such plays as Shakespeare's "Midsummer Night's Dream" intelligently and charmingly, designing costumes and stage scenery. After a library story hour, the children want the books in which the same or similar stories are found, to take home to read. And the books should be on hand to be read while interest is fresh.

Great Educational Value of the Story

Giving Variety to the Program

A story-hour program should have variety. There should always be a humorous story, a nature story or myth, a hero story and—for little children—a rhythmic or fairy tale. For older children, where the same ones can be brought together once a week, an epic should run serially. Then there should be a biographical hero story, a nature story and a humorous one, such as Don Quixote and the Windmill. For example, a good Christmas program for little people would include the Indian myth, "Why Evergreen Trees Keep Their Leaves in Winter" (Nature Myths by Holbrook), "The Bird's Christmas Carol," by Wiggin, to teach the duty and pleasure of sharing with others; the story of "Snow Baby" (Peary's little daughter who was born in an Eskimo village) and "The Greedy Cat," a rhythmic fairy tale that, in a humorous way, describes the penalties of over eating. This is in Dasent's Norse collection. For older children, Howell's "Christ-

Seeking Fresh Material

Aesop

mas Every Day in the Year" supplies the fun; John Burroughs' account of his little wild winter neighbors, the nature interest; the story of Sir John Franklin, heroism, and "The Vision of Sir Launfal," "The Other Wise Man" or "When the

Chimes Rang," the spiritual meaning of Christmas. The story teller should avoid the stereotyped, and should hunt for the little known. The best success cannot be had without a wide knowledge and appreciation of the best in literature.

Story Books and Books About Story Telling

Text Books. Stories to Tell Children and How to Tell Stories to Children, by Sara Cone Bryant; Story Telling, What to Tell and How to Tell It, by Edna Lyman; The Story Hour, a magazine published in Washington, D. C.; The Story Hour, by Kate Douglas Wiggin and Nora E. Smith; Some Great Stories and How to Tell Them, by Richard Thomas Wyche.

Sources of Rhymes, Fables, and Fairy Tales. Mother Goose, Æsop's Fables, The Nursery Rhyme Book, collected by Andrew Lang, the works of Hans Christian Andersen, Jacob Grimm, The Arabian Nights, collections and translations by Andrew Lang, Joseph Jacobs, Sir George Dasent, Johnson, Scudder, Laboulaye. Kipling's Jungle Book and Just So Stories and the Golden Window, by Laura E. Richards, should be in every library. Compton has collected Indian fairy tales and Ozaki, Williston, Roulet and Dutton, the Japanese. Donegal Fairy Stories are retold by the Irish writer, Seamus McManus.

Myths: Nature Myths by Flora J. Cooke, Nature Myths and Through the Year in Myth and Song by Florence Holbrook. Old Greek Stories by the poet, Josephine Preston Peabody, Greek Heroes by Charles Kingsley, The Wonder Book and Tanglewood Tales by Hawthorne, Wigwam Nights by Dr. Charles Eastman, a full blooded Sioux, Wigwam Stories by Judd, The Basket Woman by Mary Austin. Norse myths have been collected by Guerber, Hamilton Mabie, Sarah Bradish, and Sir George Dasent, Myths of the Middle Ages by S. Baring Gould, Gleanings in Buddha Fields (Japan) by Lafcadio Hearn.

Epics and Legends. Hiawatha by Longfellow, The Odyssey for Boys and Girls by Church and by Andrew Lang, The Golden Age by Baldwin. A story teller should have the original Mallory on the King Arthur Cycle, but work from Tennyson's Idylls of the King, and from Sidney Lanier's Boy's King Arthur or How-

ard Pyle's three books. Marshall's is the standard account of Beowulf, the Saxon hero, and this is well told by Madame Ragozin, the author of similar condensations of Siegfried and Roland. Baldwin's Roland and his Siegfried are good. The Cid (Spanish legendary hero) by C. D. Wilson, Sigurd the Volsung (Norse and Icelandic) by William Morris, Rustem the Wonder Child (Persian epic of Shah Nameh, rivalling the Arabian Nights), translated recently by Elizabeth Reninger, The Kalevala (Finnish), translated by Crawford. Joseph Jacobs, Lady Gregory and other Irish writers have collected many tales of Ireland's heroic periods of Cuchullin and of Finn.

Nature. Wild Animals I have Known, Lives of the Hunted, Animal Heroes and other books by Ernest Thompson Seton. Uncle Remus books by Joel Chandler Harris; Jungle Book and Just So Stories by Rudyard Kipling; the works of William Long, G. D. Roberts and Dallas Love Sharp, Animal Story Book by Andrew Lang, Pierson's three books on Farm, Meadow and Ni_' t People, Animal Studies by John Burroughs and Bird Books by Olive Thorne Miller, Rab and His Friends and other Dog Stories by Dr. John Brown. Dog of Flanders by Ouida, True Dog Stories by Sarah K. Bolton and The London Spectator, Black Beauty, Greyfriar's Bobby by Eleanor Atkinson.

Biographical: Baldwin's Fifty Famous Stories, Lang's True Story Books and Children's Hero series, Poor Boys and Poor Girls who Became Famous by Sarah K. Bolton, Life Stories for Young People by Upton, Days of Alfred the Great and Days of William the Conqueror by Tappan. Brave Deeds by Trowbridge, Stories of Old France by Pitman, Historic Boys by Brooks, Joan of Arc by Francis C. Lowell, Boys' Book of Famous Rulers by Farmer, American Hero Stories by Tappan, Discovery of the Old Northwest by Tappan, Pioneers of the Mississippi Valley by McMurry, Boys' Life of Napoleon, of William Tell and of General (Chinese) Gordon by Marshall, Robert Bruce by Jeanie Lang, Boys' Life of Lincoln by Helen Nicolay, The Boyhood of Lincoln by Eleanor Atkinson, Heroes Every Child Should Know by Hamilton Mabie.

Miscellaneous Stories in General Literature. Chaucer's Canterbury Tales, Longfellow's Tales of a Wayside Inn, Evangeline and Miles Standish (Puritan Life and Character), When the King Came (New Testament Stories) by Dean Hodges, Tales from Shakespeare by Charles and Mary Lamb. Ruskin's King of the Golden River, Miss Muloch's Little Lame Prince and The Adventures of a Brownie, and Oscar Wilde's Happy Prince are modern fairy stories that rank with the classics. E. E. Hale's Man Without a Country, Van Dyke's The Other Wise Man and the First Christmas Tree, Lowell's Vision of Sir Launfal, Lew Wallace's The First Christmas, Kate Douglas Wiggin's The Bird's Christmas Carol, Howell's Christmas Every Day in the Year, Dickens' The Chimes, Alder's Why the Chimes Rang, Materlinck's Blue Bird, Barrie's Peter and Wendy (Peter Pan in story form) Mrs. Wiggin's Timothy's Quest, Dickens' The Cricket on the Hearth and A Child's Dream of a Star, Robinson Crusoe (self-reliance cycle), Ouida's Bimbi and the Nuremburg Stove, George Eliot's Effie and the Miser from Silas Marner, Browning's Pied Piper of Hamelin, Irving's Legend of Sleepy Hollow, Stevenson's Markheim and Will-o-the-Mill, Tennyson's Enoch Arden, Poe's The Gold Bug, Fouque's Undine, Goethe's Hermann and Dorothea, Mrs. Burnett's Fauntleroy, Edytha's Burglar, Sara Crewe and The Secret Garden, Lafcadio Hearn's Nun of the Temple of Anida (Japanese, in Kokora), Story of Jeanie Dean in Scott's Heart of Midlothian, Scott's Lady of the Lake and The Lay of the Last Minstrel, Thanksgiving at Plumfield Farm in Louisa M. Alcott's Little Men, Alcott's Joe's Boys, Howell's When the Turkey Turned the Tables, Wiggin's Story of the Lilac Bush, Mary Mapes Dodge's Hans Brinker and the Silver Skates, Hawthorne's Great Stone Face and the Story of Hilda in The Marble Faun. Selections from Gulliver's Travels, Don Quixote and several of Mark Twain's books, McLaren's The Bonnie Briar Bush. A collection is now to be had of the stories of the children of Charles Dickens. These are a few of the many beautiful stories to be found in general literature that the story teller may adapt for oral use for varying ages.

Three Bugs

Three little bugs in a basket,
And hardly room for two!
And one was yellow, and one was black,
And one like me, or you.
The space was small, no doubt, for all;
But what should three bugs do?

Three little bugs in a basket,
And hardly crumbs for two;
And all were selfish in their hearts,
The same as I or you;
So the strong ones said, "We will eat the bread,
And that is what we'll do."

Three little bugs in a basket,
And the beds but two would hold;
So they all three fell to quarreling,—
The white, and black, and the gold;
And two of the bugs got under the rugs,
And one was out in the cold!

So he that was left in the basket,
Without a crumb to chew,
Or a thread to wrap himself withal,
When the wind across him blew,
Pulled one of the rugs from one of the bugs,
And so the quarrel grew.

And so there was war in the basket,
Oh, pity 'tis, 'tis true!
But he that was frozen, and starved, at last
A strength from his weakness drew,
And pulled the rugs from both of the bugs,
And killed and ate them too!

Now when bugs live in a basket,
Though more than it well can hold,
It seems to me they had better agree,—
The white, and the black, and the gold—
And share what comes of the beds and the crumbs,
And leave no bug in the cold!

Alice Cary

How to Play You Are Somebody Else

ONCE there was a lady who wanted to give a Christmas present to a dear little girl friend. What should it be? Not *a* present, that anyone could go into a store and buy, but *the* present that would be mixed up with o-o-oh the best times! What do you suppose it turned out to be?

A "play lady" dress!

What One Lady Did

She remembered that, when she was a child, next to dolls she just loved to dress up in an old, rusty silk gown of mother's, a hat with a feather, a lace parasol, and go calling. She was careful to visit only those neighbors who would not laugh, but could make believe she was really grown up.

Don't You Play Lady Too?

So she made a lovely "play lady" dress out of an old, sapphire-blue satin coat lining. It had a train, lace ruffles and sparkly buttons. That

The Boy Indian

was such a bright idea that she made a boy an Indian costume, with a fearful feather head-dress. Such squealing over those presents!

The Joy of "Just Pretending"

You love to pretend you are some one else, don't you? It's just as easy! All you have to do is to say: "Let's play like," and you are queens, knights, fairies, pirates or animals. You can play "keeping school", be castaways on a desert island, be pirates, or lovely maidens imprisoned in towers, or play housekeeping and have tea parties. You don't really need costumes or stage setting, or anyone to look on and clap hands. But sometimes, at parties, you play charades, making up a play on a word, or you have tableaus.

Queens, Fairies, Knights and School Teachers

Play Actors in "Little Women"

But wouldn't you like to act a story play? You can do it, really. In Miss Alcott's story of "Little Women", Jo and Meg, Beth and Amy and Laurie acted plays in the attic or barn. Jo was the clever, literary girl. She wrote the little plays herself, and each one took five or six parts. Jo liked to play villains and ghosts and haughty queens. Meg was always the fair maiden with a lover. Amy was the fairy queen, and Beth the messenger. They had such fun making their costumes out of rags and tags and old velvet gowns; in turning carpenter to put up a stage; in painting scenery on old sheets. They did everything themselves; and when they lacked anything, the people who came to see the plays had to use their imagination, as Jo said.

Five or Six People in One

A Modern Court

Three lines deep at the back stand the sturdy Sixth Grade knights of the Table Round of the University School, Detroit. Brave Sir Launcelot, Sir Galahad, Perciva, and Bedivere—they are all here with their armor, helmets, spears and ribbon sword-bands. In front are the Fifth Grade pages and squires, in training for knighthood but not yet deemed worthy of that honorable estate.

Why Not Do It in Your School, Too?

You could do that, too. The "little women" were natural girls, not a bit more clever than could be found, perhaps, in your school. All children are good at making believe. Once

people did not think anything of this, except that it was a way that little people had of amusing themselves. But now, wise men and

of King Arthur

Each is squire to a particular knight and wears that knight's colors. At the left is King Arthur himself viewing this gathering of chivalry. Near him stands his royal bugler. In the center is King Arthur as represented by the children, gorgeous in royal purple robes and a golden crown. Below him is his jester, ready to make the court merry with his antics.

women, who really study children say that this love of play acting should be made use of in education. Dr. Eliot, late president of Harvard University, has said: "Here is a tremendous power that should be used by every school in the country, and I believe that it is going to be."

What a Wonderful Little Big World

Tell mama and teacher about that. Play acting is used in every kindergarten. The cunning little tots are flying birds, trotting horses, busy bees, growly bears, hammering blacksmiths and carpenters. Every little game and folk song has its action, helping to fix the idea. And in the first grade, children build up Indian villages, on sand tables, making arrows, tents, canoes and warriors out of paper, clay, sticks and colors. After that, in the middle grades, it is more a matter of books. And those are the years when boys and girls play make believe most, out of school hours.

The Poet Actors in the Kindergarten

How to Give a Fine Play

But if you had a chance to give a *real* play, with a story in it, and printed parts to learn, wouldn't you study hard to do it right? You would scour libraries to find out all about the historic period, the proper scenery and costumes. The boys would work after school hours and on Saturdays, to make a stage on the platform of the school assembly hall. They could screen off dressing rooms with denim or burlaps, hang a front curtain, make exits at the back, right and left. The girls would design and make the costumes of the cheapest materials—cheesecloth, cambric, cotton crepe and tissue paper. Curtain cords, old feathers, paper flowers, tinsel from the Christmas tree, shawls and blankets can all be used. A fine Roman toga can be made from a sheet. The furniture, too,

Happy Work for the Boys and Girls

A Thanksgiving Play

© Harper Bros. Little Plays

The Spirit of Thanksgiving is reading his list of names to see if it can be true that two poor little girls and their mother have been overlooked. This is a scene from a play in Harper's Book of Little Plays.

should be simple. An arm chair draped with a shawl makes a fine throne; a spring cot with a blanket or rug makes an Oriental divan. Rocks and caves are made of boxes piled up and covered with burlaps or sacking. A background scene can be sketched with charcoal and crayons on print or wrapping paper, or glazed cambric.

And Then Comes the Play

But the play! There are plenty of plays printed in books, and written especially for children. They were written by teachers and authors of young people's stories, and published by the school book companies. One book can be bought and the parts copied for the actors to study. There is one "Book of Plays for Little Actors" for children of the second and third grades. The plays are short, in one act, with many walking parts for little folks too shy to speak, but who thus learn to appear before an audience without being frightened. The speeches are short, too, and easily learned; the plots simple.

Where to Get Good Plays

Every child has heard about the pussy cat that went to London and saw a mouse under the Queen's chair. A dear little play has been made of that, with Pussy and her mistress in it, the Queen and her

A Royal Court

© Harper Bros. Little Plays

Here a princess and a brave soldier are bowing before the throne of a king. If you are a little boy, don't you think it would be fun to command the kneeling princess to rise, with a sweep of your robe and your very lordliest bow? And if you are a little girl, I know you would love to be the pretty fairy in the filmy white dress and wings.

maids and the mouse. A play has been made of Mother Hubbard and her dog, Tom the Piper's Son and other old nursery stories, like Red Riding Hood and the Three Bears. A boy with a fur coat and cap makes a fine bear.

Turning History Into Plays

American History on the Stage

For children a little older, there are Hiawatha and Puritan plays. In the play of "The First Fourth of July," the time is 1776, the place Philadelphia. Everyone wears colonial dress of buff and blue, with cocked hats. The old bell ringer with his grandson is seen on his way to Liberty Hall. The signers of the Declaration crowd about a long table. People shout behind the scenes. The stories of the first Thanksgiving, of Washington and the cherry tree, and Lincoln and the little bird have been made into plays and there are stories from history and biography, furnishing a great number of simple, dramatic plots that even little folks can act out.

Longer Plays for Older Children

For older children there are longer plays, with more characters. The Pied Piper is a beautiful

drama in which many little and big children can act. Such stories as that of William Tell, Nathan Hale, Daniel Boone, Joan of Arc, Captain John Smith and Pocahontas, The Ugly Duckling, Eppie and the Miser from Silas Marner, and others dear to the heart of childhood, are very fine for acting. You learn many things in doing them well. You learn the best stories in literature. You learn the beauty and force there is in good English. You learn to stand and walk easily and gracefully, to speak clearly and with expression. Most of the books of plays for children have stage directions and descriptions of costumes. Some of the plays can be given out of doors, on a lawn, in a park or grove.

Thanksgiving Day

© Harper Bros. Little Plays

This is good old Thanksgiving Day with his pumpkin pie and carving knife. Doesn't he make you think of a good dinner with nuts and apples and cranberry sauce? He is one of the Holidays who wanted to rebel against Santa Claus in "The Revolt of the Holidays."

And Shakespeare Himself Looked On!

It may help you to think you could give a play in your school or home, to hear what others have done.

Shakespeare Played Before Shakespeare

In Lincoln Park, Chicago, there is a statue of Shakespeare, seated in a marble chair. On the poet's birthday the children of the Junior Dramatic League and classes from public and private schools hold a pageant around the statue. Fifteen hundred of them marched in procession on one occasion. One group formed Queen Elizabeth and her court, another the actors of the Globe Theater and Shakespeare's friends there. Other bands were characters from his plays—gloomy Hamlet, distracted Ophelia, fat Falstaff; limping, scowling Richard III, wise Portia, dancing Perdita and the shepherds, and many others. The smallest children of all took the parts of Titania, Puck and Oberon and their mischievous band of fairy attendants. It was truly a wonderful spectacle.

How Fairies Study Literature

There is a famous school, too, that begins in the kindergarten to train children to act good literature. One

Midsummer Night's Dream at School

year "A Midsummer Night's Dream" was played in the school assembly hall. The seventh and eighth grade girls designed and made the costumes; the boys did the stage carpentering and managing; the principal parts were acted by fifth and sixth grade pupils. The kindergarten and first year pupils were fairies. The stage was the open platform, decorated with branches and tissue paper flow-

ers. The seats and grottoes were burlap "rocks," the stars electric lamps. The actors came and went in full view, as Ben Greet's out-of-door company of English players do. It was all natural and beautiful, the children scarcely acting at all, but "making believe," living the sweetest fantasy of the greatest of all dramatic poets.

What wonderful things they learned in presenting that play. And do you think one of those who took part will ever forget it?

Books of Plays

Here are some of the little books of plays that would be a help to you:

"The Book of Plays for Little Actors," published by the American Book Company of New York. Intended for children of the second and third grades.

"Children's Classics in Dramatic Form," published by Houghton, Mifflin Company, Boston. Five volumes, graded from the first year to the eighth.

"Harper's Book of Little Plays," Harper and Bros., New York. For children of ten to twelve.

"The House of the Heart" (10 plays) and "The Silver Thread" and other folk plays, published by Henry Holt & Co., New York.

"Comic Tragedies." These are the plays written and acted by the little women of the Alcott family, before the age of seventeen. Little, Brown & Co., Boston.

Hamlet's Instructions to the Players

Speak the speech, I pray you, as I pronounced it to you, trippingly on the tongue; but if you mouth it, as many of your players do, I had as lief the town-crier spoke my lines. Nor do not saw the air too much with your hand, thus, but use all gently; for in the very torrent, tempest, and, as I may say, the whirlwind of passion, you must acquire and beget a temperance that may give it smoothness. O, it offends me to the soul to hear a robustious periwig-pated fellow tear a passion to tatters, to very rags, to split the ears of the groundlings, who for the most part are capable of nothing but inexplicable dumb-shows and noise: I would have such a fellow whipped for o'erdoing Termagant; it out-herods Herod: pray you, avoid it.

Be not too tame neither, but let your own discretion be your tutor: suit the action to the word, the word to the action; with this special observance, that you o'erstep not the modesty of nature; for any thing so overdone is from the purpose of playing, whose end, both at the first and now, was and is, to hold, as 'twere, the mirror up to nature; to show virtue her own feature, scorn her own image, and the very age and body of the time his form and pressure. Now this overdone, or come tardy off, though it make the unskilful laugh, cannot but make the judicious grieve; the censure of the which one must in your allowance o'erweigh a whole theatre of others. O, there be players that I have seen play, and heard others praise, and that highly, not to speak it profanely, that, neither having the accent of Christians nor the gait of Christian, pagan, nor man, have so strutted and bellowed that I have thought some of nature's journeymen had made men and not made them well, they imitated humanity so abominably.

The Way the Morning Dawns

This is the way the morning dawns:
Rosy tints on flowers and trees,
Winds that wake the birds and bees,
Dewdrops on the fields and lawns—
This is the way the morning dawns.

This is the way the sun comes up:
Gold on brook and glossy leaves,
Mist that melts above the sheaves,
Vine, and rose, and buttercup—
This is the way the sun comes up.

This is the way the river flows:
Here a whirl and there a dance;
Slowly now, then like a lance;
Swiftly to the sea it goes—
This is the way the river flows.

This is the way the rain comes down:
Tinkle, tinkle, drop by drop,
Over roof and chimney top;
Boughs that bend, and skies that frown—
This is the way the rain comes down.

The Training of Young Children

A Visit to a Model Kindergarten

The Froebel doorway of the Wheelock School, Boston, "suggests the motto and the spirit of the Kindergarten, 'Come let us live with our children.'"

THE South American delegate was visiting schools. The guide was Helen's mother, an ex-Kindergartner. To-day they were to visit the Kindergarten.

They were approaching the school. "This is one of the few buildings in the State constructed especially for Kindergarten use," said the guide. "We build magnificent High School buildings with fine equipment for the small number of pupils who ever reach that stage, but the Kindergarten children usually take their chances in any room, not needed for other purposes. This building approaches our ideal. It houses the Kindergarten and first three grades. It is only two stories high so that little children may avoid the fire and other risks of a large structure with many stairs. Notice the court yard with space for games, and for the out of door hand-work in suitable weather."

Inadequate Provisions for Kindergartens

The Garden for the Little Gardners

"I notice also," said the delegate, "the yard at the side, laid out in garden beds, and the vines and flowers about the building."

"Yes, each division has a community garden cared for by groups of children who are chosen each season. Some of the children promise to be responsible for the summer care of the garden, so that there is a goodly

display of vegetables and flowers at the harvest festival held in the fall.

As the Great Teacher Had Planned

"There are also individual beds as you will see by noticing the children's names on the cards placed at each bed.

The Little Gardeners

"Each division has a community garden cared for by groups of children who are chosen each season." The hats and sunbonnets were made by the children themselves.

"Gardening was a part of the original Kindergarten plan and Froebel himself directed the children of Blankenburg in the laying out and cultivation of flower beds on a pleasant terrace of the town. The diagram of the first garden is still shown and the terrace is now a playground for the little Thuringians."

Over the doorway to the Kindergarten wing of the school-building was a bas-relief representing Froebel with a group of children. "This suggests the motto and the spirit of the Kindergarten," said the guide. "Come let us live with our children."

Froebel and the Children

Froebel was a pioneer in child-study. He lived and played with real children and so came to know their needs and their characteristics. From his sympathetic understanding of child life he was able to devise a system of child-training and materials for occupation based on laws of growth."

The Beginning of the Day

The sound of children singing came through the open door and the visitors hastened to enter. They were in time for the Morning Circle. The children sat around the teacher in a friendly group for the opening hymn and songs. A song of greeting was followed by a hymn, "Father we thank thee for the night." Then came songs of the season and "telling the news." The news concerned the autumn leaves, nuts, flowers seen and enjoyed, and home happenings. This opportunity for conversation furnished a fine language lesson.

A weather record was made by marking the calendar with a yellow spot to denote sunshine, and the chil-

Building with the Third Gift

"The gifts are educational play materials arranged in sequence to meet the needs of the growing child." "Froebel calls his Third Gift—a box of 8-inch cubes—the child's joy because it offers such wide possibilities for representation."

dren sang:

"This is the way sunshine comes down,
Sweetly, sweetly falling,
So it driveth the clouds away,
So it bringeth the lordly day,
This is the way sunshine comes down,
Sweetly, sweetly falling."

"From every point in nature leads a pathway to God," quoted Helen's mother. "These morning songs are to confirm the child's feeling of a Presence that lives and moves in all things. They lead through nature to God."

"Kindergarten children are encouraged to see with their eyes, to hear with their ears, and to find new sources of joy and wonder in the 'Great, wide, wonderful world.' The morning talk gathers up the threads of varied experience and makes of them a common interest. It is social and allows interchange of observations. Sometimes a little rhyme or poem is taught or a story told. The Kindergarten lays stress on these beginnings of literature, believing that they will not only awaken the desire to master the art of reading, but will quicken appreciation of what is best.

Kindergarten Aims and Methods

"Practice in story-telling, and the study of story literature is an essential part of a Kindergartner's training. Stories are carefully chosen from the standpoint of the child's understanding, but always with reference to their artistic value. We do

not believe in foolish stories, but we ardently believe in a wise culture of the imagination and in the presentation of ideals in the form by which the soul of the race has been nourished. I like to quote our great English story teller, Marie Shedlock. 'And so our stories shall contain all the essentials for the child's scrip on the road of life, providing the essentials and holding or withholding the non-essentials. But, above all, let us fill the scrip with gifts that the child need never reject, even when he passes through the gate of sleep.' "

In the Kindergarten Circle

At the Kindergarten Tables

Now the children are moving. We must see what happens next.

The circle was broken and each child took his little chair, marching to the accompaniment of music to his place at the Kindergarten table.

"A most excellent training in order and control," commented the visitor.

Some rhythmic movements followed, suggested by the piano and interpreted freely by each child. Waving trees and flying birds were represented, and, anon, the line became a merry dance or a lively skip.

The children now grouped themselves at tables placed socially around an open square. The tables were of different heights and the chairs were suited to the occupants. A group of younger children gathered at a long, low seat under a sunny window. Their first care was the window box. Dried leaves were removed, and watering pots were filled to give the geraniums a drink. Large building blocks were then found by the children. They made a group on the floor to build a green house within a walled garden.

"This was suggested by a trip yesterday to the Botanic Garden," the student observer explained.

Good Training in Co-operation

Each child joined in the representation, some building the wall and gateway and others combining for the green house. The number and height of window and door spaces

Stick Laying

Some of the children are making designs with sticks while others are making the same designs on the blackboard.

required much calculation and consultation with the observer.

The older children at the tables were provided with bundles of sticks varying in length from one to five inches. This material was carefully distributed by one of their number who waited by each recipient until the appropriate, "Thank you," had been said.

"I see the Kindergarten trains in courtesy and willing service," remarked the visitor.

"Yes," said the guide, "It is never too early to train for that

"Best portion of a good man's life—
His little nameless, unremembered deeds
of kindness and of love."

Froebel's Conception of Education

The children at the tables had also visited the Botanic Garden, and the suggestion was made that they should make pictures of the windows of the green house. One recalled a "triangle" window over the door, and that was outlined by a proper selection of sticks. Then the door underneath was framed by using five-inch and two-inch sticks. Other windows, square and long, were made by different children and panes were introduced, square and diamond in shape. Several children combined to make a line of windows of uniform size for one wall of the green house.

"The beginnings of geometry," said the visitor.

Roots of the Arts and Sciences

"Froebel maintained that the use of his simple materials and tools made the beginnings of the arts and sciences," was the answer. "Science begins in observation and investigation—and art, in free representation.

Stringing Beads

"The Kindergarten emphasizes sense-training for this reason. A seeing eye and a listening ear mean an awakened mind. The key note to Froebel's plan is creation. He desires a busy child, and a happy child. In one of his commentaries on the mother play, Froebel makes a plea for the training of the hand and also for what he calls a complete activity. He says:

> There is but one means of avoiding wrong activity, but rejoice, friends of childhood and humanity, for it is a sure preventive. This preventive is right activity, an activity as persistent as it is fit and lawful—an activity which is not a body activity alone, or yet of the heart or head, an activity wherein are blended body and soul, feeling and thought. To capacitate the child for this pure and complete activity, we must begin in infancy to exercise and discipline hands and fingers. (*Mottoes and Commentaries of Froebel's Mother Play.*—Translated by Susan E. Blow.)

How the Child Spends His Senses

"This period of table or group work we call the gift lesson. The gifts are Froebel's agencies for developing, first, the child's attentive interest in the world around him. The world to be known through seeing, touching, handling; and second, the power to tell what he sees by various means of self-expression. These means are the simplest play materials, blocks, balls, tablets for design, sticks, rings, seeds and shells. Since Froebel's time the gifts have been supplemented by larger building blocks, by nature materials and other useful means of self-employment.

Froebels Gift Lessons

"Shall we look at the doll house which is the result of the combined effort and interest of all the children?"

In the corner of the room was a two-story doll house, made of two strong hat boxes. "These boxes were contributed by one of the fathers," the guide explained. A sitting room,

bed room, dining room and kitchen were furnished with chairs, table and other pieces of furniture made by the children of spools, boxes, cardboard and various materials.

The Doll as a Teacher

Helen, who had put away her sticks, came over to her mother. "See what a cunning chair Charlie made out of a match box!" she said. "And the bookcase is new. That's Byron's. His mother gave him a spool box to make it, and look at the stairs and the bed! We all cut spreads out of paper and then chose the prettiest one. See the fringe on this one. Isn't it lovely!"

"This is the Dolly That I Love Best"

"Then dolls are not excluded from the Kindergarten?" asked the visitor.

"How could they be, when the children love them so?" said Helen's mother.

"This is a Polish doll," Helen explained. "A lady gave us that. It was made by poor sick soldiers in the hospital. This is the doll the Chinese children play with. And don't you like the Dutch doll and the doll in the cradle?"

"You should hear, 'This is the dolly that I love best,' and the doll lullaby," said Helen's mother.

The Indoor Games

"The children are now forming a ring," said the Kindergartner, who had joined the group. "The games are indoors today for the benefit of our visitors. We play in the court until late in the fall on pleasant days."

The games chosen by the children were varied. Skipping, running, alternated with such representative plays as:

"Fly little birdies, you must go,
Soon will come the ice and snow."

And a trade play:

"Rap-a-tap and tic-a-tac-too,
This is the way to make a shoe."

A good old folk play, "Round about the village," ended the merry circle, and the children were ready for a quiet rest. The sleepy game was played to relax tired little muscles and rest weary little brains. Only the ticking of the clock could be heard in the room.

"This is our silence game," said the Kindergartner. "It helps to preserve the rhythm of movement and rest. It has always been a part of the Kindergarten program. Sometimes we use it after the table work when there has been special concentration in thinking out some problem of construction."

Choosing a Game

When quiet time was over, little heads popped up one after another, and the sleepy spell was broken. Nods of "wide awake" were exchanged by the children.

But still the room was quiet, and folded hands on the table waited. "We'll think a little of what to do," said Miss Ella. "You may tell me what you would like to do."

The Occupation Period

On the table before her were a basket of geranium leaves, a vase of cosmos blossoms, a pile of sewing cards, a package of drawing paper with colored crayons, large pencils, worsted and needles placed invitingly around.

A Kindergarten "Telephone Exchange"

"When you have thought what you would like to do, you may come up and choose."

A veritable choice of delights. There was a moment of pondering. Then one and another came up, and took a sewing card, or a leaf with drawing paper and crayons. Each one whispered his happy choice—"A square window," "A long window," "A green leaf," "A picture of flowers."

"This is well named the occupation period," said the guest.

"It really occupies. See how alert are eye and hand," the Kindergartner answered. "It gives the best industrial training, because it promotes a love of work. The training of the hand Froebel deemed of importance from the very start, in order that what the children produce later may have real worth. But the fine arts are needed, too, to make life fine. Life is more than meat, and body than raiment. Industrial training alone may give ability to earn a living, but not to live. A child loves beauty. He loves to make something. He loves also to make something beautiful. It may be a wind-swept landscape made by a few dashes of water color, or a daffodil blooming on a straight stem, or an autumn leaf outlined and filled in with colored crayons. The picture is crude, to be sure. It must be crude; but the child is the little artist and has the joy of creation. 'A man may see what he maketh,' said Emerson. The Kindergarten child who draws pictures of what he sees, who colors the leaves he enjoys, who models in

The Joy of Creating

clay a cup or a vase of pleasing form is daily discovering the lesson of the Rhodora—that

"Eyes were made for seeing,
And beauty is its own excuse for being."

"In the last song of his Mother Play, Froebel tells us what he believes about this creative power of the human being, and what its beginnings in childhood signify. There is the book. You would no doubt like to read it for yourself. (*Mottoes and Commentaries of Froebel's Mother Play*. D. Appleton and Co.) I must return to the children for our closing hour has come."

A scene of busy activity followed. The finished cards were placed on the teacher's table and marked with the child's name. These were later put in the work book which each child was making to keep as a record of his progress.

"At special times like Easter, Valentine's Day and birthdays of the fathers and mothers, the work is made into some gift form and taken home," said Miss Ella. "For two or three weeks before Christmas the little hands are busy making tokens of love for home friends. The Christmas tree is hung with gifts and chains and lanterns made by the children. The Christmas festival is shared by mothers and a few fathers that are able to come. It is a festival of giving, and our children know that it is more blessed to give than to receive, for they have tried it."

Developing the Spirit of Giving

While we were talking, other children with unfinished work had found their portfolios and put the cards and papers away. These portfolios with other properties were kept in drawers under the long, low seat running around the room. Each child had his own drawer.

"Let me show you the contents of their drawers," said Helen's mother. "Here are the two boxes of building blocks in frequent use. These are technically called the Third and Fourth Gifts. Sheets of drawing paper, squares for cutting and folding are also kept here, as well as a box of paints, and the special tools of the Kindergarten—crayons, pencil, brush, scissors and needles. The individual drawers serve to fix the feeling of responsibility and sense of possession. They must be kept in order, and each child learns to find and put away things for himself. Some parts of the material are still kept in bulk, however, and distributed, as you have seen today, for the sake of training in order and courtesy."

Training in System and Order

The Good-Bye Songs

In the meantime groups of children had been in the dressing room and returned with coats, and the boys with hats in hand. "Most of them have learned to dress themselves," said Miss Ella. "The big ones help the smaller ones, if there is a refractory button, and all goes well. Now for our good-bye."

In a group around the Kindergartner the children sang:

"Our Kindergarten is over, and we are going home,
Good-bye, good-bye, be always kind and true."

"Let's sing, 'We'll all come back tomorrow,'" said Little Joe. Many voices began to sing:

"Our play is o'er, our work is done,
Our things are in their places;
Now to our homes we'll quickly run,
With happy hearts and faces.
We'll say good-bye, but teacher dear,
We'll all come back tomorrow.

With cordial handshakes and good-byes to the Kindergartner, the

"observing" students and to the guests, the children departed.

The canary was suddenly still and the sunshine flooded the silent room.

"I see that you do not forget the small sweet courtesies," said the delegate. "Now, if you have time, will you explain to me a little further the ideas which govern your practice —the reasons for some of these things?"

The Kindergartner and Her Work

"Nothing could give me more pleasure," was the response. "The Kindergartner's work is her cause, which she serves with the loyalty and devotion of a reformer. She rejoices in an opportunity to serve her cause. The Kindergarten in America was fortunate in having for its first exponent a woman of rare culture and discernment—Miss Elizabeth P. Peabody. She was an unwearied advocate of the new system of education. She journeyed, wherever people would listen, to preach the gospel of Froebel. Through her influence, women of culture and insight first responded to the call for teachers of the new system. To her we owe the standard of work and training which has been maintained in this country. The early workers struggled against the lack of appreciation and support which always accompanies the advocacy of new ideas. None could enter the ranks from sordid motives. The pioneer period was a time of self-denial and struggle. There were no pecuniary considerations to lure those seeking only a means of livelihood. 'Kindergartening,' Miss Peabody declared, 'is not a craft. It is a religion; not an avocation, but a vocation from on high.'

"You see I know my book," said Miss Ella, with a reminiscent look. "We learned that in our training school. It gave us the keynote of our calling. That belief creates the attitude of Kindergartners to their work.

"The first published accounts of Froebel and his work we owe to Dr. Henry Barnard, our first commissioner of education. In one volume of his Journal of Education he made a collection of Kindergarten Culture Papers. These papers with Miss Peabody's book, published in 1886, constituted the first literature on the subject in America. These books are still valuable. They have the historical value. They help also to hold us to the early conception of the work of the Kindergarten as a service to childhood and humanity.

Books for Parents to Read

"Miss Peabody's book should be studied today by mothers and teachers for its intimate and sympathetic understanding of child life. The latest important account of Kindergarten theory and practice is published in a book called *The Kindergarten; Reports of the Committee of Nineteen,* published by Houghton-Mifflin Co. The Committee of Nineteen was appointed in 1903, by the International Kindergarten Union. The reports were made by three leaders, Miss Susan Blow, Miss Patty Hill and Miss Elizabeth Harrison. This book is for those who wish a philosophical presentation of the system. It is of special worth to students of education and to the profession.

"There are simpler statements of Kindergarten principles such as Miss Nora A. Smith's *Home Made Kindergarten* and Miss Harrison's *Study of Child Nature*.

"But I am shifting my answer to

the shoulders of these writers. You asked for my statement of underlying theory. To me the aim and practice of the Kindergarten is defined by it name, Child Garden. A gar-

Little Plants It Pays to Grow

Planting Bulbs in Pots

Nature study is, of course, a prominent feature of kindergarten work and the little botanists learn to know, by actual experience, the whole life of the plant.

den is a place for growing things. The function of a gardener is cultivation of the plants. The goal for the child is *growth,* growth in wisdom, in stature, and in favor with God and man.

"The teacher's goal is knowledge of childhood and of individual children, in order to give the sympathetic guidance born of such knowledge.

"Froebel was the first of modern students of child life. His appeal, 'Come, let us live with our children,' indicates his method of study. His laboratory was a group of children in the home with their mothers, or in the playground, following him, their beloved friend and leader.

Pilgrimages to Froebel's Home

"When we made the famous Froebel Pilgrimage in 1911, we found in Schweina an old man, who remembered, as one of the chief pleasures of his boyhood, the invitation to play with Froebel, at Liebenstein. We saw in Blankenburg the square where Froebel and Middendorf, gray-haired old men, played with the village children. We have notes and letters written by Froebel, during the winter he spent in Dresden. He lived in the family of a friend in order that he might try out his gifts, and watch their effect on the children. The disciples of Froebel, like him and like that mother of old, blessed above all women, keep all these things and ponder them in their hearts!

"In the first picture of his Mother

Play book, Froebel shows us a mother sitting with her children on the bank of a stream. The children are playing. One boy has made a water wheel, which is merrily turning in the running brook.

Children as Prophets of Their Own

His brother is watching and thinking. 'What makes it go?' he is asking himself. He is of the thoughtful type, a future philosopher, it may be. One little girl, vigorous and active, is wading in the brook, while her sister sits quietly by the mother, content to look on. The mother watches and ponders. In each child's play she sees the promise of a future. But no two are the same. Each needs special guidance suited to his temperament and needs. The mother must watch and study and ponder that she may guide wisely. She knows one thing, however, which is true of every child: He grows and develops through his own self-activity. What he does, what he plays, is making him. He must grow in stature, that is in body. He must grow in intelligence. He must also grow in favor with God and man, or, to use the Kindergarten phrase—he must develop right attitudes towards his playmates, and towards the world which surrounds him. The secret of child development is the secret of giving full play to all the inner promptings to activity.

A Play Festival

"In the Land of the Free"

"Freedom is necessary to growth. This freedom is first physical. The baby must kick and play that his limbs may grow strong. The healthy child at home never keeps still.

The Mother and the "Why?"

He runs all about the house, touching, testing, experimenting and asking questions. The home is the first school. It is the school of self-activity through which mind and body grow. The mother is the teacher. Her part is to guide, to provide right materials, and to answer the many *'Whys'* asked by an inquiring mind.

"Now, later, when the child comes into the Kindergarten, is he any different? Is he not a creature still keenly alive and eager to know? To require the child to sit immobile and perfectly still for half an hour is to go contrary to the teachings of his own nature. That is why we have frequent changes of position and frequent changes of exercise. A child's energy needs relaxation and new channels of expression. The Kindergarten recognizes the fact that mind, like body, grows by use. Self-activity is our method. The little child is an eye.

The Child Is All Eyes

He wishes to look into everything which moves and stirs. He loves to see color and note form. Gradually he begins to know and to classify objects, as his perceptions are trained.

"We recognize Nature as the first great teacher. The glory of Froebel is that he founded a school without

books. The story book of Nature is the text book of the Kindergarten. Its pages are filled with the songs of birds, the humming of bees, and the song of the brook. To Kindergarten children there are 'tongues in the trees, sermons in stones and good in everything.' They learn their first lessons from these things.

Reading Things Before Books

"Of what use to master the mechanics of reading, until one has ideas with which to read? Words are barren until life gives them meaning. Dr. Montessori says that her Italian children, who had burst into reading and writing, had little interest in the story books brought them by kind friends. They could call the words, but they were not ready to read.

"A seeing eye, a listening ear, a trained hand and an eager mind—these are the preparation the Kindergarten offers for the school arts. Interest and attention are fundamental forms of self-activity. The native instinct of curiosity is the child's incentive to knowledge. It is aroused by all that surrounds him, about which he wants to know. It is satisfied by directing the child's own self-activity into the pathway which leads to the answer of his many questions. 'Look,' 'Listen,' 'Try again,' 'Work it out.' These are good answers to many questions. The Kindergarten materials offer scope for experiment and investigation. Sense plays for touch, smell, taste, hearing and for quick perception are often used.

Avoiding Overemphasis in Arithmetic

"We do not teach arithmetic in the Kindergarten. A knowledge of mathematics is not necessary to a four year old. Any premature instruction arrests development.

"Mr. Joseph Lee well says in his *Play in Education:* 'It is true, for instance, that the immature hand, which might have squandered its time on dolls, may be taught to hold knitting, and in a year or two almost knit. So the imagination that sees a cow or a steam engine in what really is only a piece of wood can be set right, and the child put to work,

Imagination and the Utilities

instead, in studying the difference between spruce and maple. He could thus be made to acquire, in three years of the dramatic age almost as much practical knowledge on that head as a child of ten would pick up in ten minutes, but meantime the age for the inward realization of the family, the trades related to it, and other things that really interest the child—of obtaining a sympathetic insight into his surroundings—will have gone by, and left its all important function unfilled.'

"However, we do begin counting or numbering and calculation as it is called for in the use of materials. 'One, two, buckle my shoe'—'One little, two little, three little Indians'—'This little pig went to market,' are universal favorites. They open the door to the world, 'so full of a number of things.' We are indeed happy as kings when we begin to grasp this world of quantity. One method of grasping it is to know *what, how much, how many.* Some of these exercises involve illustration of mathematical relations. The process is always simple and child-like. For instance, we use a home scene. Let us take *half* our blocks for mother's table, and divide the other *half* to make chairs for father and mother. Again our train of cars is to

be made from eight cubes. We may count out half for the cars and half for the engine. Or again, we build a tower and transform it into two posts, and so on.

"Froebel's gifts are educational joy, because it offers such wide possibilities for representation. A whole set of toys is contained in this box. The magic wand of the child's constructive imagination releases all its delights.

Out of Door Plays—Drop the Handkerchief

play materials arranged in sequence to meet the growing needs of the growing child. They are easily handled and lend themselves to mathematical divisions, which give simple and fundamental number experiences. Their chief function is to serve as means of self-employment, and self-expression. Every child is by nature a *maker* and *doer*. A hill in the sand—a hut of boughs—a tent made from an umbrella—something, he must make. All he needs is material and tools with which to work.

Purpose of the Froebel Gifts

"Froebel calls his *Third Gift*—a box of eight inch cubes—the child's

"We attach some importance to the use of these gifts in their order, and to an occasional following of sequence in arrangement of forms. Such guidance in arrangement gives a clue to the labyrinth of experience, and helps children to see things in their proper relations, and to trace causal connections. Free representation is, however, the main purpose of the Froebelian gifts.

"The Baroness Marenholtz von Bülow, who was Froebel's first and best interpreter, found the keynote of his system in the phrase: 'Man is a creative being.' Children must create freely in order to discov-

The Child's Discovery of Himself

er their own powers and to be themselves.

Function of Stories and Poems

"Another need of childhood, for which the Kindergarten provides, is the need to know about other people, and what they have done.

"History and literature began when the first fathers told their sons the traditions and legends of the tribe. History and literature begin in the same way today. So the Kindergarten program includes a story hour. Rhymes, little poems and stories foster the interest in the wonderful world. They quicken the feeling of kinship with living things. Take, for instance, Rosetti's verses:

When father takes the spade to dig,
  Then robin comes along,
He sits upon a little twig,
  And sings a little song.

But if the tree be very far,
  He does not sit alone,
He comes up close to where we are,
  And bobs upon a stone.

"Such bits of poetry give form to language, an increased vocabulary, and appreciation of what is good. Stories are carefully chosen for their literary form, their dramatic quality and for their presentation of ideals of life, which kindle the desire to go and do likewise. It is not safe to leave the exercise of the imagination to chance. The most lordly of all faculties should have direction into legitimate channels. We wish to make every mind 'a mansion for all lovely forms; the soul a dwelling place for all sweet sounds and harmonies.'

"Shall we not help to supply these forms? Shall we not guide in the choice of sounds and harmonies?

"The story is the mirror which shows the child himself. It helps him, therefore, to correct his faults. 'The story is the strengthening bath for mind and judgment,' says Froebel. It helps to a right decision between right and wrong and to good moral choice. The *real* story, as the children call it, may bind together the children's experiences, and so serve as a review of the day and an aid to memory.

"But I am not delivering a lecture on the story. Of what else shall I speak?"

Play as "Serious Business"

"Explain to me the purpose of the plays which are carried on in the circle," said the visitor. "Are they for gymnastic training or for diversion? That is, are the plays merely play?"

"No play should be idle," was the answer. "Boys 'fool' and 'rough house' on street corners, because they have no playground and no work shops, because they have not learned how to play. Play, according to Froebel, is the child's serious business. Into it he puts the earnestness and the effort which a man puts into good honest work. And remember the man also does best to whom his work has the zest of play.

"The playground in every town and city is proof of the national conviction that there is a connection between the boy's play and the man's job. The wise Aristotle had little hope for the boy not diligent in his play. He does not promise to be diligent at anything. Froebel was the first to recognize and utilize the educational value of play. He saw in the child's make-beleve a means of understanding. To fly like a bird is to be a bird. To be a father bird or mother bird is to gain interest in bird life. To impersonate is

Play Insight and Sympathy

to penetrate the soul of the things represented. Sympathy is awakened and a desire to protect. A new boy had come to a Kindergarten in the country. The first day he was taken by a group of children to see a ground sparrow's nest in a clump of grass near a rock. The new boy reached out to take an egg. 'Oh, you mustn't do that,' protested the others. 'There's a baby bird in it and the mother would miss it.' The man who 'would needlessly set foot upon a worm' was not bred in a Kindergarten.

"The little girl becomes tender by nursing her dolls. The boy becomes knightly by being a knight. Imitation leads to understanding. A wide range of imitation is necessary to sympathy with man and bird and beast.

"Froebel left us with typical plays which we have since greatly increased and expanded. These plays concern the great relationships of human life—to nature—to man—his work and his institutions. They are means to that growth of which I spoke before.

"The gymnastic value of Kindergarten plays you have already recognized. Skipping, running, jumping, dancing, rhythmic movements of arms and legs are arranged to give balanced exercise, muscular development and control.

The Dignity of Labor

"The trade plays, such as the baker, blacksmith and carpenter, give some wisdom regarding the world's work, and strengthen the voice within which whispers: 'Work waits for me.' They help towards a proper recognition of the service of all workers and they give dignity to labor. This attitude towards work is also fostered by the hand work, some of which you have seen this morning.

The Desire to Produce

"The baby loves to do for the sake of doing, but the four year old or the five year old wishes to do *something.* He wishes to *produce.* A vase in clay, a paper mat for a tea tray, or a chain of seeds—be it what it may be, it is the child's own, and he has the joy of the maker. The habit of industry is fostered by breeding the love of work."

"One thing remains," said Helen's mother, "of which we have not spoken, the highest of all—religion."

Social and Religious Aspects of the Kindergarten

"Do we need discuss that?" asked Miss Ella. "For the children religion is an atmosphere, not a creed. The religious feeling is stirred by the morning hymn. Miss Peabody calls song the language of spirituality. It arouses what is true and tender within the heart. Reverence begins in wonder. The wind, the moon, the stars, the meanest flower that blows, these make the pathway to wonder, along which the soul mounts to a vision of the divine.

"The social atmosphere of the Kindergarten is the great school for the emotions. In favor with God and man is our ideal. We understand the divine through the human. We love to serve each other and so serve the common Father.

"In the Kindergarten plays a child learns to surrender his own desires. He learns to look out for the weaker and younger. He finds his happiness in the magic of 'together.' In the group and table exercises children learn how to work together, and how to help each other. The public Kindergarten is a true melt-

ing pot of the nations. Here all are friends and playmates, not rivals. Here all are needed by each one and true cooperation is to be found. The child garden is the larger family where all are brothers and sisters."

"A true school of citizenship," said the visitor, as he rose to go.

"The world to be is planted here," said Helen's mother.

May Day Festival

Peter Paul Augustus

(A Kintergarten Song)

Said Peter Paul Augustus: "When I am grown a man,
I'll help my dearest mother the very best I can.
I'll wait upon her kindly; she'll lean upon my arm;
I'll lead her very gently, and keep her safe from harm.

"But, when I think upon it, the time will be so long!"
Said Peter Paul Augustus, "before I'm tall and strong,
I think it would be wiser to be her pride and joy
By helping her my very best while I'm a little boy."


"IN THE PAGES OF GOOD BOOKS LIES THE MAGIC TO INSPIRE OUR DREAMS AND THE POWER TO MAKE THOSE DREAMS COME TRUE"